

No.
63

THE MAGAZINE OF TOMORROW

AUTHENTIC SCIENCE

FICTION MONTHLY



ARTICLES : Air data transducers Machines to win coal

STORIES : By J. T. McIntosh E. C. Tubb H. K. Bulmer, et al.

ISSUE No. 63

AUTHENTIC SCIENCE

FICTION MONTHLY

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H. J. Campbell writes

News and views from the editor . . .

AT GREAT POPULAR REQUEST, we bring you again in this issue the first part of a two-instalment serial by J. T. McIntosh. Letters concerning his *The Big Hop* were unanimous in their praise. Many thought it was the most mature piece of science fiction that we have published. And all asked for more. Well, now you have it in *The Lady and the Bull*. I hope you like it as much as the last one.

There's another piece in Tubb's series on the mis-adventures of the likeable scalliwag, Dusty Dribble. Notable returns this month are Martin Jordan, Eric Wilding and Len Shaw. They've been with us before, and we hope to have them again.

On the non-fiction side of things, I think you can't grumble. Apart from the excellent unillustrated articles, you have a set of pieces accompanied by some highly interesting pictures. 'Triona Law gives us the first of two pieces that show us the woman's angle on the future—a special feature for our many female readers. Would you gals like more of this?

Don't forget—I will run articles on any subject of wide interest that you care to suggest, so let me know what you want. One point about this, though: don't, please, write and ask for an article on, say, atomic energy, or space travel. Narrow it down a bit. Give me a subject that doesn't require half a dozen books to do it justice. Your topic will have to be covered in a couple of thousand words, so let's have some selectivity.

The more observant among you will have seen, by close examination of the Contents page, that I have become the proud possessor of a London University Bachelor of Science degree. Never averse to blowing my own trumpet, I take this opportunity of pointing it out to those who *didn't* notice it and of mentioning, casually, of course, that it was an Honours degree. I do this solely—as you will have surmised—in order that you may know how authentic *Authentic* really is.

I take your congratulations for granted. 'Bye now. H.J.C.

About the cover . . .

. . . Guided Missiles

ONE OF THE THINGS THAT modern physical science is bringing home to people is the tremendous inefficiency of the human body when it comes up against anything out of the ordinary run of natural phenomena. Flying fast, flying high, computing and a whole lot of other man-designed occasions cast a revealing light on man's bodily limitations.

And science has to take account of them. Once upon a time—not so very long ago—the business of the physical sciences was limited to finding out about nature and to making machines for man to handle. Now science has to spend a lot of time worrying about whether man *can* handle the machines, and often finding that he cannot.

In the beginning of aviation science, efforts were directed at designing a machine that would stay up in the air. That is still an important thing, of course. But a great many aviation scientists are con-

cerned with making gadgets that will keep inefficient man more and more out of the picture.

Our cover this month shows the wide range of devices that can be fitted to a modern plane, functioning automatically and recording things that man could never know otherwise.

A few years back the job of a test pilot was to take a new machine up and study its performance. The plane's future depended upon what he had found out about it. Today, though the test pilot's comments are listened to respectfully, he is mainly merely a pilot. His main job is to do his damndest to keep the plane flying—while the electronic instruments find out how it is performing. The plane's future depends upon what the little magic boxes say, rather than upon the testimony of a mere man.

You can read about these things in detail on page 23.

SILICONES ARE SUPER

THE SCIENCE OF WATER-REPELLANCY

YOU'VE SEEN THE advertisements. Silicone car polishes, silicone floor and furniture polishes and silicone impregnated cloth and tissues for lens cleaning. Silicones for waterproofing clothes and silicones for this and that.

And there are far more uses for silicones in the manufacturing industries than in the home. As for the future, with cheaper methods of manufacture, they could easily become one of the largest synthetic products on Earth or the other planets of the Solar System. The raw material silicon is one of the most plentiful elements on the heavier planets.

Silicones are not new. The first ones were produced fifty years ago, but it has only been during the last ten years that large-scale manufacture has made them available to the public. It is their properties that are new, almost out of this world.

Just what are silicones, and how useful are they? Can they stand up to the claims made in the advertisements? The answer is quite definitely that they are outstanding, and that claims made for them are understatements.

A chemist will tell you that silicones are organo-silicon-oxide polymers—which means that they are large molecules of a plastic in which part of the carbon has been replaced by silicon oxide . . . sand. They are



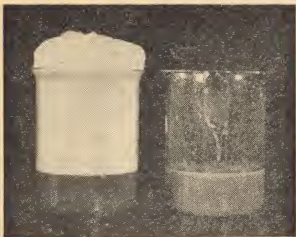
Silicone-treated
Nylon Marquisette

hybrids, partaking of some of the properties of glass and some of those of organic compounds.

It is here that silicones have the edge on practically every other material. Whilst natural silicon compounds have long been used because of their heat-resisting and electrical-insulating properties, they are unsatisfactory because they are brittle and weak. Such are asbestos and mica.

On the other hand, most organic carbon compounds are extremely unstable to heat, melting and charring at relatively low temperatures. Silicones have the adaptability of organic materials and are also heat resistant.

Carbon atoms have the ability to join to one another to form chains, rings and complex three-dimensional networks of atoms, and it is this uniqueness that makes the chemistry of all the living creatures on Earth, organic chemistry, possible. An infinite number of carbon compounds could be synthesised—in fact about half a million have been made. Silicon is a metal and cannot do this, but it does form an oxide which can join its molecules together to produce larger molecules. It was by using this ability that chemists, particularly those of Dow-Corning and the General Electric Company of the U.S.A., were able to synthesise the whole range of liquids,



Untreated soap solution on the left;
Silicone-treated soap solution on right.

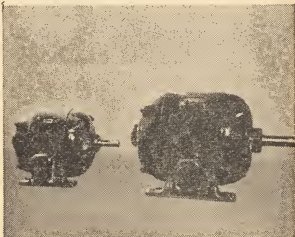
oils, greases, plastics and rubbers that are known as silicones.

They are part of the advances which had to be made when machines began to be used under the far more rigorous conditions of modern warfare and the approach to the borders of space, when many of the conventional materials are useless. An ox cart moving at three miles an hour can use practically any lubricant, even water, but a machine operating at 20,000 revs. a minute at several hundred degrees Centigrade needs something special as a lubricant. And it's not much

have some of the reasons why silicones are unique.

In two words, they don't. They don't corrode metals, they don't burn

use building a superhigh-altitude bomber if the bomb-bay doors won't open because the grease on the hinges has frozen to a cement at $-70^{\circ}\text{C}.$, where even mercury sets to a solid metal. But the viscosity, the stickiness, of silicones alters little between -70 and $400^{\circ}\text{C}.$ Add to this the fact that they are resistant to weather and oxidation, evaporate only very slowly at high temperatures and don't form sticky deposits, and you



Glass-insulated 5 h.p. motor on the right; Silicone-insulated 5 h.p. motor on the left.

easily, they don't freeze easily, they don't react with other plastics, they don't dissolve in water. They are the most inert liquids and plastics that are known. But because they are inert it does not follow that they are lazy; the number of tough jobs that they are tackling where other molecules turn up their toes and quit trying must be incalculable.

The raw materials for silicones are

widespread and easily obtainable. Pure sand, silicon oxide, is the basis and the synthesis starts with heat, plenty of heat. Sand and coke are heated to 1,700° C., a third of that at the Sun's surface, in an electric arc furnace. There the silicon oxide loses its oxygen and becomes molten, elemental silicon. The most modern of these furnaces produces one and a half tons of silicone every three hours. The silicon is cooled, ground

and reacted with chlorine gas to produce the tetrachloride, which is further reacted with other chemicals until the required type of silicone is produced. A large number of processes is involved, the reason why silicones are still expensive. Specific types of silicone molecules can be "tailored" for specific jobs.

The first use for silicones that brought them to the public eye some six years ago was as an additive to polishes. A little silicone fluid compounded with a car or furniture polish enables it to be spread easily and a high polish to be obtained by gentle rubbing; the elbow grease that

used to be wasted in getting a good surface finish can now be saved for more important jobs. And a surface of silicones is water and beer repellent, and won't crack easily.

Pardon me if I sound enthusiastic—I've been using these polishes.

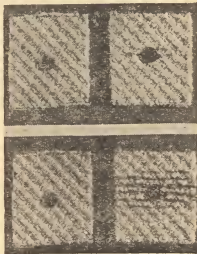
Those small pieces of tissue paper impregnated with silicones that are used to polish glasses. Ever tried them? The thin film of silicones left

on the surface of the glass prevents dust and fingerprints from sticking to the lenses as well as giving the surface a new brightness.

The water repelling properties of silicones are not so well known—water seems to dislike silicones so much that it rolls itself up into the smallest volume possible, just like mercury, and won't penetrate into fabrics and concrete that have been silicone impregnated. But they are still pervious to air and vapour. There

don't seem to be many silicone treated clothes in the shops, perhaps because only the synthetic fabrics, such as nylon and terylene, can so far be treated. When more are available they should do away with the need for raincoats, for why carry a raincoat when your ordinary clothes are water repellent?

Silicone fluids are so individualistic that they'll have nothing to do with other fluids, oxygen or electricity. Which makes them ideal for brake fluids, electric insulation and instrument damping. They can be used in



Top: Treated fabric with ink drop on application and after 2 secs.; Bottom: Untreated fabric with ink drop on application and after only 30 secs.

overload relays and in sextant bubble levels that can be used in the polar regions or at the Equator.

Their individualness makes it difficult to remove an ultra thin film of them from a surface so that, as they do not harden, they are ideal adhesives, preventing sticking together. Many industries used to have a great deal of trouble with materials sticking to moulds—the older adhesives, such as soaps, oils and powders, did help a little, but they, in turn, soon charred and melted and the problem was to prevent *them* from going up the works. Now silicones are used to spray the moulds used in making rubber tyres, reducing the cost of maintenance by 90 per cent. and improving the surface finish of the tyres. Silicones are used to treat resin-bonded sand moulds so that the sand does not stick to the metal, whilst another silicone is used in the baking of bread.

For hundreds of years it has been the practice of bakers to grease their bread pans with organic fats. These prevent the bread from sticking to the surface, but the fats quickly char and the smoke of the burning grease leaves an unpleasant film on walls and ceilings. And the charred fat is very difficult to remove from the pans. Now, one coating of a silicone, inert and non-toxic, is enough to release over 200 bakings without any charring or smoking. It will even prevent frozen foods from sticking to cold metal surfaces.

We use silicones in our laboratory as lubricants for glass surfaces and as inert, high-boiling liquids in high vacuum pumps and liquid baths. Their very large temperature range of usefulness and small vapour pressure makes them ideal for most work. At times, we wonder how we ever managed to do without them.

When silicone fluids are mixed with fillers and metallic soaps they form greases that are used in ovens and refrigerators and under Arctic conditions.

One of the most curious properties

of silicones is their ability to act as a defoamer—only a few parts per million added to a foaming beer or wine fermentation kills the formation of the semi-permanent bubbles of carbon dioxide that fill up valuable space and cause the liquid to overflow. Even soaps can no longer foam in the presence of silicones. As a veterinary aid, it is used to deflate bloated cows, releasing the gas in a bovine belch that saves them from a painful death.

Silastic is the trade mark of a silicone rubber that is unaffected by heat, ultraviolet light and ozone, the killers of the elasticity of most rubbers. It is formed by treating straight chain silicones so that the molecules form cross linkages to bind themselves together and is now utilised in the gaskets for steam irons, for sealing high altitude aircraft and anywhere where insulation is required to be flexible between -70 and 260° C. It's used in jet engines to cover the heating coils that prevent ice forming round the air intake ducts. At -70° C., when ordinary rubber cracks like glass when hit with a hammer, Silastic is still resilient.

Being water repellent so that moisture cannot form a continuous, conducting film on its surface it is also used to cover spark plugs and to seal the junctions in radar and radio equipment.

One of the most important uses for silicones is one where all of its properties come into play—as insulation for the windings of electric motors. The usual insulating materials such as varnish, cotton, paper, wood and rubber soon break down if they become overheated by an overload. Even the slightest crack or pinpoint in such insulation allows moisture to enter and provide a conducting channel. The heat-stable materials, such as glass and ceramics, are too brittle, and asbestos and glass cloth cannot, on their own, exclude moisture.

The problem was only recently overcome by mixing silicone varnishes and

Continued on page 17

The way to the Planets

by A. E. ROY, B.Sc., Ph.D., F.R.A.S., F.B.I.S.

5—*Laboratory in Space*

THE TECHNICAL SIDE OF astronomy is based on three major instruments—the telescope, the camera and the spectroscope. We saw (*Authentic*, August, 1955) that a fourth is in process of development, namely the electron telescope or image converter. The space station will be the fifth.

It is impossible to be too optimistic in judging the amount of information an observatory above the Earth's atmosphere will bring us. Every branch of the subject will be revolutionised. Many problems that have baffled mankind for generations will be solved by even a moderately small telescope on the space station.

The advantages the space station brings to astronomical research are two in number: the observer is above the sea of air and he, with his instruments, are in free fall.

The biggest refracting telescope is at Yerkes in America. Its lens is forty inches in

diameter; it is supported by a steel tube 60 feet long weighing many tons, pivoted on a massive steel pier. This great instrument has to be rigid yet capable of any movement. A dome, 90 feet in diameter, built of steel girders, sheathed with wood and roofing-tin, revolves on wheels round a circular track so that two shutters, 85 feet in length, can open to disclose that part of the sky to be observed.

The largest reflecting telescope is the 200-inch one at Mount Palomar, in use since 1950. Here the mirror weighs about 14 tons, is supported by a tube of girders weighing over 100 tons, while this tube rests in a yoke some 300 tons in weight. Yet this mirror and its supports must remain rigid to a few millionths of an inch, no matter how the instrument is tilted. Such a telescope is a mechanical masterpiece.

It is extremely unlikely that larger refractors and reflectors will ever be built—on Earth. The engineering problems be-

come insuperable, simply because of the force of gravity at the Earth's surface. The optical problems themselves are incredibly complex. Shaping the 200-inch mirror to an almost perfect parabolic curve took nearly seven years. After that, an aluminium coating, a few millionths of an inch thick, which serves as the reflecting surface, had to be applied.

A telescope will be a greatly simplified instrument when built on the space station, or in a special observatory situated in the orbit some distance behind or before the station. In its weightless condition, the telescope structure need have only enough strength to remain stiff. Indeed, once the mirror or lens had been moved into its proper place, it would stay there without exerting any strain on the light framework joined to it. Thus optical instruments may be much larger than those on Earth.

In fact, however, even a small telescope would open up new vistas in astronomy. For the telescope is above the atmosphere, perhaps the astronomer's chief headache. It is sometimes harder for an Earth-bound astronomer to penetrate those few miles of air than the billions of miles

beyond. Astronomers say that there are "good seeing conditions" when the air above the observatory is quiet and still. Then photographs are clear and sharp—though never as clear or as sharp as they would be if the atmosphere was absent. The image of the planet Mars at its most favourable opposition in the 40-inch Yerkes refractor is only one tenth of an inch in diameter. If this image is enlarged by interposing an enlarging lens, the new image is fainter. To get a photograph, an exposure of a few seconds is necessary. During that time the image is moving about because of the turbulence of the Earth's atmosphere so that faint detail is blurred beyond recognition. When a similar telescope is built in the space station or near it, the image of Mars will be enlarged and exposed for minutes without any blurring due to movement. And then, the plate developed, the astronomer in the station darkroom will gaze entranced at the first objective proof that the Martian surface is covered by a geometrical pattern of canals—or is not!

From such an observatory, too, Mercury could be observed at almost any time by "blocking out" the sun. Since

there is no atmosphere in the telescope's vicinity, the sun's rays will not be scattered and dispersed. Photographs of certain craters on the Moon would be useful to discover just what are the causes of the mysterious changes in them reported by observers such as Moore and Wilkins.

In general, conditions for planetary observation would be far beyond anything experienced in a terrestrial observatory, and before the first orbit-to-orbit spaceships take off from the vicinity of the station, conditions on the Moon and planets will have been thoroughly checked by observers at the space-telescopes.

We have said that the space station's observatory may be placed before or behind the station in the same orbit. There are a number of reasons for this. The station itself is unsuitable since it will probably be rotating. Again it would be awkward to have a really large telescope attached to the station which may vibrate with its own traffic. If the observatory lay above or below the station it would, according to the laws of celestial mechanics, suffer drift-motions relative to the space station.

The construction of this flying observatory raises a number of questions, some easy to answer, some rather more difficult. Covering the surface of the mirror with its metallic coat is relatively simple because of the vacuum of space. The electronic equipment can operate without the complication of vacuum seals. Surfaces must be shielded from rapid temperature changes caused by Sun and Earth. The observer will probably operate the telescope by remote control.

Dr. Whipple, of the Department of Astronomy, Harvard College Observatory, has recently described many of the problems in astronomy that the space observatory could tackle. Apart from the surface features and atmospheres of the planets, the Sun will be studied extensively. The most interesting parts of the solar spectrum, lying in the ultra-violet, X-ray and gamma ray regions, are hidden from the terrestrial observer. Only lately has some information about these regions been collected by spectroscopes mounted in high-altitude rockets. But from the satellite station there will be available the entire solar spectrum from one angstrom unit in wavelength

(10^8 cms) up to radio waves, for, apart from optical telescopes, really large radio-telescopes may be constructed in space.

Dr. Whipple also points out that in stellar astronomy the spectroscope, with its ability in the space observatory to utilise the whole of the spectrum, will provide any large telescope, or even several of them, with problems for generations. These problems will concern not only the nature, composition and evolution of stars, but the processes going on in their atmospheres. In recent years, in multiple star systems it is becoming clear that such systems may be extremely complicated, with possibly the circulation of large rings of hydrogen round one of the components and the accretion of matter from the interstellar medium. If the origin of planets is a natural process, as some astronomers believe, instead of by accident, the fresh information gained by the study of spectrograms taken in space of various types of stellar systems may confirm that stars give birth to planets. Indeed, the large telescopes of the station may be able to detect planets of the nearer stars. One such method

that has been proposed lately is interesting. If a star the size of the Sun had a planet the size of Jupiter circling it and coming each revolution between the star and the Earth, the star's light would be reduced regularly by one one hundredth of its usual amount. Such a difference could be measured now with a modern photoelectric photometer—even on Earth.

Another important problem the space observatory will probably solve is the composition of the interstellar medium. Once we get beyond the Earth's atmosphere it will be possible to obtain the amount of all trace elements in this medium. At present, only a few of them have been determined. Many astronomers believe that the great gas and dust clouds of the Milky Way are the birthplaces of stars, and that even today stars are being created in great numbers. Some stars are about 3,000,000,000 years old, according to modern astrophysical theories. These stars are parsimonious in their expenditure of hydrogen, turning it slowly into helium, and will probably last an equal or greater length of time. Down the time-scale we come to the spendthrift stars

which will consume what is left of their hydrogen in under a million years and cannot be more than that age. It seems likely, then, that the spend-thrift stars at least are still being created in the Milky Way, condensing out of the gas and dust clouds that in mass more than equal the mass of all the stars taken together. Again, we want to know how the interstellar medium has changed in composition during the 4,000,000,000 years the universe has been a going concern. Perhaps the heavy elements have always been there since the initial explosion; perhaps

they are added to the medium every time a supernova "blows its top."

As Whipple said: "The observatory in space may well reveal the secrets of the origin of the universe itself. The most important problems for the space astronomer may then become new ones, beyond the horizons of our science today."

Thus, if for no other reason, the creation of the space station may be worth while, a step in man's long quest for relevancy and meaning in the universe in which his little life is spent.

NEWS

FLYING FOOTBALLS

THESE PAST FEW WEEKS, THE newspapers have been full of the reports that the Americans are going to set up unmanned artificial satellites within the next two years. Some of the newspaper accounts make strange reading; one newspaper consistently referred to these satellites as flying saucers; another published their artist's explanatory account in

which a modern-type plane (the satellite!) was suspended in a "non-gravitational belt" of space that presumably surrounds the Earth. The legend below the drawing further confused the issue by stating that the satellite would be placed at the point where the Earth's gravitation was cancelled out by the Moon's gravitation. This is a

good trick if it can be done. There is such a point, of course, but as it is about 220,000 miles above the Earth's surface, it seems rather far away for an unmanned satellite Earth. In any case the point is one of unstable equilibrium. A body placed there would very rapidly depart from it to become either a satellite of Earth or the Moon, or perhaps to collide with one of them.

Most of the accounts, however, stuck to the facts. A number of metal spheres, about 19 inches in diameter, will be sent up into circular orbits about 250 miles above the Earth's surface. The spheres, packed with scientific instruments, will probably be the third stage of three-stage rockets of the type described in previous articles of this series. The information collected by the instruments will be telemetered back to Earth. The last wisps of the Earth's atmosphere at that height will still be sufficiently dense to provide friction enough to gradually slow down the satellites' velocity so that they lose energy and spiral in after a few days. As they dive deeper into the

atmosphere they will be destroyed by the heat generated by the increasing friction just as most meteors burn up long before the ground is reached.

The Americans' announcement was, of course, quickly followed by a claim from the Soviet Union that their scientists were, if anything, ahead of their rivals and that their unmanned satellites would be sent up within two years. There has also been some suggestion that a British Commonwealth satellite should be put into an orbit for the Geophysical Year two years hence. It is rather fortunate that there is an infinity of possible orbits about the Earth so that the probability of a Soviet satellite colliding with an American one or a Commonwealth one and provoking an international incident is vanishingly small.

Seriously, we see that man is about to take his first step into space, and that the manned space station may be less than twenty years hence. We must hope that it will be neither American, nor Soviet, nor Commonwealth, but a United Nations one.—A.E.R.

MACHINES TO WIN COAL

Some new types of equipment being tried by the
National Coal Board

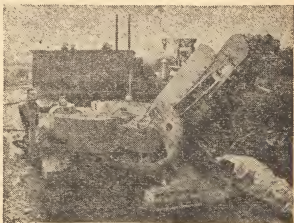
THE PRESENT CONCEPTION OF mechanisation in the mines assumes that hand work can be virtually eliminated and mechanical power used to extract coal from the seams, convey it to the surface, and start it on its way to the consumer. The achievement of this aim would mean dispensing with hand hewing, shovelling, and many other heavy manual tasks in favour of the more efficient methods now on trial.

The contribution of power-loading to the output of British mines was negligible until after the war, and although the present field of investigation is very wide the progress achieved has brought new problems affecting the preparation of coal for the market. Machines can now be used to win coal faster, more economically and with greater safety, but they have no power of selection and generally cause the

design machines which can improve production and also sustain a reasonable supply of large coal.

All the early efforts of mechanising work at the coalface were directed to producing a machine which would cut a slot in the solid wall of coal and loosen it for filling off, the slot being about five inches thick and taken usually from the bottom of the seam. The first machine, produced in 1861, consisted of a revolving disc with cutting picks attached; the disc was later replaced by a chain to carry the picks and this type of machine had become universal by 1930. It became standard practice to undercut the coal and prepare it for filling by blasting it down with explosives; as single shift it became necessary to speed up the filling operation by using conveyor belts instead of hand loading into tubs. The first conveyors were made

product to be broken down into smaller sizes than is the case with hand methods. In particular, the production of large coal tends to decline as more machines are installed. This situation has been met in part by the activities of the C.U.C. in promoting the use of appliances which can burn the smaller sizes, but Coal Board experts are alive to the need to



THE CONTINUOUS MINER

of steel and pulled by a chain, but rubber belt conveyors made their appearance in the late 20's. By 1922, a mere ten per cent. of all coal produced was being cut mechanically; development moved forward in the next ten years and about a quarter of all coal was being cut and also conveyed mechanically by 1932, and more than half by 1942. This rate of progress was sustained in the next decade and

required new methods of mining. Conventional mining divides such face operations as cutting, filling and moving over the face conveyor into three shifts in a 24-hour cycle. One of the modern trends is to move back to a system of continuous mining in which the miners complete all the operations associated with face work on each shift; little progress would have been made without the new

type of armoured conveyor and the quick-release props which have so helped to speed up the rate of face advance.

Some of the new machines are carried on top of the armoured conveyor which can be advanced section by section as the face goes forward. In the new installations coal can be won, the props advanced, and the coalface made ready for this series of operations to be started all over again by the men on the next shift.



COAL PLOUGH

by 1953 the percentage of coal mechanically cut was 83 while about 90 per cent. was mechanically conveyed.

The most obvious way in which to bridge the gap between mechanical cutting and conveying was to develop a machine which would both get the coal and place it on a conveyor, thus dispensing with the arduous work of shovelling and the expensive use of explosives, but the movement from the old system of hand filling into tubs over to longwall conveying had brought with it a less flexible system in the employment of manpower and it was soon realised that new machines

The Meco-Moore was the first cutter-loader to prove itself in pit conditions and it is by far the most effective machine of its type in operation. It is an extension of the ordinary longwall cutter in that it employs picks carried on a chain to attack the coal, but has two jibs (one at roof and one at floor level) as well as a third vertical jib which shears the coal from the back of the cut and assists it to fall on to a small cross-loading belt which transfers it to the face conveyor. More than half of all power-loaded coal is won by these machines, which weigh about ten tons and have been most

successful so far under relatively good face conditions.

A comparable American combined cutter-loader machine, the Continuous Miner, has been highly successful but its extension is limited for conventional work in British mining conditions and only a few machines have been installed. It attacks the coal with an action similar to that of an electric razor; the cutting head is "sumped in" at the bottom of the seam and raised upwards, while the coal is flung backwards onto an intermediate conveyor carried on the machine. It may have a useful employment in driving entries for tunnels. Experiments are also being conducted with the Marietta Miner, also an American machine, which was designed for tunnelling in coal and it is hoped to adapt it, too, for driving through stone.

The Meco-Moore does excellent work on long-wall faces but is not suitable for thin seams or steep gradients, neither is it the final answer to breaking down the conventional cycle of mining. But experience with this and other machines has brought new knowledge and there are now at least three different approaches to mechanising coal-getting and loading.

The most common process is the cutting and slotting method used on ordinary coal cutters and such developments of them as the Meco-Moore and the Gloster Getter, which is similar to the Meco but has a simplified loading device. Experimental machines in this class include the Anderton Disc

Shearer, which resembles a drum with cutting discs fitted and attacks the coal vertically, and the Multi-Jib Cutter which is likely to be suitable for work in thin seams, especially for coking coal where breakage is not important.

A second method, developed since the war, is that of stripping coal from the solid with a wedging or ploughing action. This system, developed in the soft seams of the Ruhr coalfield, has now been adapted to British mines and many types of ploughs are being tried in the softer seams. There are twelve Step Knife Ploughs at present in use which have a series of blades and take a strip up to 12 inches deep. They have done useful work, but it is likely that the Fast Ploughs, which strip off from about 2 inches to 6 inches at a time and are driven from the conveyor gear-head by means of



MECO-MOORE CUTTER AND LOADER

Photo: National Coal Board

chains, will have a wider application.

Another promising machine is the Scraper Box Loader, a German adaption of the method used for many years for loading coals in the thin seams of the North of England. A series of bottomless boxes are fitted

with cutting knives which dig into the coal and bring it down for the boxes to load. Four of these installations are already working and several more are planned.

Other ploughing experiments are with the Dutch Multi-Plough in which a number of small ploughs are disposed along the face instead of one large one, and the Huwood Slicer, which is designed to take a 12 inch cut but travels more slowly than most of the ploughs.

The third process now being tried for coal getting is the rotary method, although this is still in an early stage of development. The Anderson-Boyes Trepanner, with a rotary head which cuts out and breaks off the coal and passes it to a conveyor, has shown promise and it is hoped that a double-headed machine now being prepared will prove more valuable. Another novel experiment, the Auger, is in quite a different field. It works on the same principle as a carpenter's drill cutting into wood. An N.C.B. team

investigated this machine in America and some experimental work has been done in this country, although this has been held up until a satisfactory method of ventilating the auger holes has been found. The auger is likely to find a useful if limited employment in places where only partial extraction of coal is possible.

There has been an encouraging rise in productivity in recent years both at the coalface and for all workers employed. The overall figure of 1.21 tons a manshift reached in 1952 was a record, and in the early weeks of this year productivity at the coalface has been about 31 tons a man. Some indication of the contribution made by power loading can be measured by comparing this latter figure with the average of 6 tons a man obtained on power loading faces. Only a few tons were power loaded in 1946. In 1953 more than 6 per cent. of annual production was produced entirely by machines. Full scale mechanisation has started and the momentum will increase.

SILICONES ARE SUPER

Continued from page 7

resins with asbestos and glass cloth to form a really first class insulation. The immediate result was that the older motors were rewound with silicones to insulate the windings and then run at up to twice their old ratings—naturally, they got hot, hotter than was previously permissible, but they stood up to it. Modern motors now being built can do the same job as older ones twice the size and weight. And the silicone protection lasts at least ten times longer than the previously used varnishes. In the U.S.A. alone, savings in space, materials and repair and production time are already running into millions of dollars.

There are drawbacks to silicones. They are expensive, they cannot be

used where you want foam to form and the silicone rubbers are neither as flexible nor as strong as natural rubbers. But scientists are still working on them, and when you weigh the disadvantages against the advantages of silicones, it is possible to see that they are going to be more useful in the future than they are now.

Silicones will be important in the age of space. With man on the point of stepping into space we need to re-evaluate the materials that we normally use and think in terms of new environments and new synthetics to meet the challenge. When the first piloted spaceship leaves the Earth there is one thing of which you can be certain—silicones will be on the job.

Desirable Residence 1995

BY 'TRIONA LAW

“MY DEAR, HOW NICE TO see you! Did you have a good time at the Moon Convention? I wish I could have been there, too.

“How do you like my new house? It was finished the day after you left. Come and have a look at it and see if you still want your Tudor cottage once you’ve been through it.

“I like this new globular shape, don’t you? Just like they have on the covers of those old science fiction magazines John treasures so. Only think, back in 1955 it would have been one of those square boxes of a house and nothing like as convenient.

“You remember we were going to have the diggers take out the foundations just before you left? Well, the builders brought the machines along—just like the ones they used for digging trenches in the middle of the century. It

didn’t take any time at all—they were finished digging before I had a cup of tea at eleven. And the builders started pouring the foundations the same day. Oh, yes, straight on the soil. We don’t have to worry about damp-courses now—they use that silicone-treated concrete, and apparently that keeps all the moisture outside. It was set really hard in a night, so we video’d the Plastics Corporation and they brought out the machine for building the house the next day.

“Foamer, they called it. It looked rather like a big concrete mixer crossed with a fire engine. There were two funnels that they put the chemicals into, which joined up into a bulbous affair right in the middle. That was surrounded with lots of tubing and gears and things. Then from the other end there ran

a long, flexible tube with a nozzle. The builders had set up the girders in the concrete and the whole thing looked rather like two round bird cages stuck together till the plastics men came and started work.

"It looked so easy, too—you could hardly call it 'work.' Do you remember seeing pictures of those old scrubbing boards they used to have at the beginning of the 1900's? There's a strange old woman down the road who collects them . . .

"Yes, that's the one I mean; she's collecting all the pieces for an exhibition. Well, they had a thin metal sheet shaped rather like one of those, with the ribs on it, and they slid it in between two of the girders and then turned the foamer on it and sprayed it till it was covered with about six inches of foam. Do you like the colour? I wanted pink and John rather fancied green and neither of us could decide. But we both like yellow, so we compromised and had that instead. They add the colours as they put the chemicals in, you know; any one you want.

"Once they'd got the whole sheet covered, they used what they called an 'irradiator'—uses hard X-rays or radio-

isotopes or somesuch, and it makes the foam set hard. Links up molecules, I think, though I'm darned if I understand how it does it. Once it was hard they just took the metal sheet away and started on the next section. The whole thing was done in a day, and now we can slide the walls back in grooves one behind the other.

"Windows? Of course we have. Look, let me just slide this wall back. See? Glassite. It's another plastic. The architects just send the measurements along to the Plastics Corporation and they make it. We've got a sheet of that behind every wall, so we can have all walls, or all windows, or a mixture of both. The glassite slides along, too, just in case the ventilation seems a bit too manufactured and we want to feel 'real' fresh air.

"The same thing with the walls—they all slide. We've got a wall under each girder and that makes six rooms in this globe. There are only five in the other because I wanted a big kitchen and we had two sections thrown into one. You'll see. Come inside and have a look round now you've seen what it looks like from the garden."

"What was that?" . . .

"Oh, no, we don't need handles. We've got an electric ray across the door on each side so that when we step up to that, the door opens automatically. Go on, try it . . . See? John did tell me how it worked but I can't tell one electric motor from another, so I'd only get muddled if I tried to explain it.

"We've got it set out as one big room at the moment. We slide the walls in front of the bedrooms at night but the rest of the house is open most of the time. We shut John's study off if he wants to work, and if there are guests we usually leave the passage in the centre—I'll show you that in a minute. During the day we leave most of the walls in front of the spare bedrooms.

"That metal pillar in the centre is quite a combination. It helps to hold up the girders, it's the ventilation duct, and hold on while I press this button . . . There, how do you like that? All the bottom sheets slide up and show electric fires, and when we don't want them any longer, I press another button . . . so . . . and down they come again and you'd never know there were any fires there. Saves such a lot of dusting

with a smooth surface like that.

"Of course, we don't rely much on the fires, although electricity is cheap enough now all the atom power stations are churning it out. I can't think why you don't go in for one in that big fireplace of yours—it could always be modelled to look like a big log fire. And it's so *clean*. Tell you what, if everyone like you turned over to electric fires, we'd never need any more coal miners. Besides, it's so difficult trying to get smokeless fuel now there's so little coal left in the mines. And you have to be so *careful*, too. One puff of smoke and blooie! £50 fine! Still you like those old Tudor chimneys, don't you? And maybe an electric fire wouldn't be quite the same thing.

"Of course, we don't rely on the electric fires. They are just for emergencies. We got one of those soil heater/coolers they were experimenting with twenty years back. You know the thing. Wires running through the soil in the garden. Summertime, we take the heat out of the house and put it into the garden like Jane does. My! Shouldn't you like to see her orchids? Just imagine their growing in the

open in Scotland of all places! I'm looking forward to next summer to see what I can grow. Think I might try orange trees, or maybe even pineapples? . . . I adore pineapples.

"Winter, of course, it works the other way round—takes heat from the soil and puts it back into the house. John said it's as if the house were a refrigerator in the summer and the garden one in the winter. I think I knew what he meant, but I'm not sure. It works, anyway.

"Let's see, what have I shown you? The heating, the ventilation, oh, yes—this is fun. I don't need a vacuum cleaner any more. Just press a button and—oh, don't get too close! Your dress will catch on that duct there. It sucks in all the dirt for me. Of course, I have to remember not to leave papers lying around or they block it up and finally get torn into the duct—oops, I didn't. There goes Jane's letter now. I'd better switch it off . . . that's better. There's one in all the rooms. The ducts lead up through our central pillar to a bin outside and John empties it once a month.

"Of course, normally we don't see the metal pillar. If

we close all these walls round it . . . see, from in front of the bedrooms . . . we've got a nice wide passage so you can go from one room to another without going through any more rooms. *So* convenient for guests, I always think.

"We're in the living room at the moment—we usually consider the outside wall of that as the front door, though of course, we can come in through any other wall if we want. But the electric ray is fixed for that one and it's the most convenient for our purposes. Then, if we go round clockwise and imagine all the rooms closed up, we've got our bedroom next, then the bedroom we're saving for when we have a family. Then the guest room. There's a narrow slice off that and the dining room next to it, so that it can act as a passage to the next globe. Beyond the dining room there's John's study and then we're back here again.

"If we go through the passage, we go straight into the corner of the kitchen, then clockwise again we've got the bathroom, John's workroom, the spare room, and then the laundry next to the kitchen. Remember the kitchen's only so big because we've got the wall missing from between

two sections. That wall there, between the kitchen and the laundry, is fixed. All the kitchen equipment is fixed on small trolleys so that each piece can be moved if I want, but I decided it would be easier to have everything fixed against the wall. The same with the laundry the other side.

"Of course, with the bathroom here, we needed another passage and that works in exactly the same way as round the duct pillar in the other globe. Only we keep the walls in place instead of sliding them back, and only move them to leave or enter a room . . .

"Yes, they are big rooms, aren't they? Each globe is thirty feet across, so from wall to passage is 12 feet. And when we want bigger rooms for a party, we just slide all the walls back. We don't need any bigger plot than they did back in the fifties for a bungalow—ours is only 50 feet wide and 200 feet long, and the house only takes up a section 30 feet by 60 feet. Of

course, when I say that, John quibbles a bit and says it's not quite 60 because the living room globe takes a bite out of the kitchen, so there isn't quite two diameters, but after all, what's a few feet difference between friends?

"Oh, yes, we've got lavatories in the bedrooms as well as in the bathroom. We just had a section blocked off, and they've got a wash basin in each, too. But, my *dear*, the bathroom has *everything* . . . shower, bath, basin, bidet, a drying vent . . . just *everything*!

"And the kitchen. I have such a wonderful time—friges and freezers, ovens, cupboards. Even though I've been in it a month, I keep wanting to try all the gadgets over and over again . . .

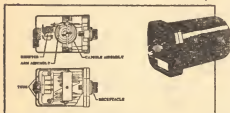
"Yes, I expect you're right; the novelty *will* wear off soon. It's to be expected. Now come and have a cup of tea and tell me *all* about the Convention before you see all my gadgets. It'll take ages to show them to you . . . Tell me, did you meet . . ."

AIR DATA TRANSDUCERS

UNFORTUNATELY, HUMAN SENSES are nothing near as accurate as are required in this age of machines. Now, with our aircraft and guided missiles flying well above the speed of sound, we are finding that

Differential Pressure Transducer

The difference between total ram and static pressures
(function of indicated airspeed) or any other two given pressures



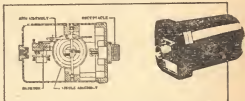
our nerve and brain responses are not only inaccurate but are also far too slow. What the future will hold, when rockets will regularly operate at tens of thousands of miles an hour, depends to the extent to which we can use machines to control machines to further control machines.

Already we have half the answer—air data computers and components. So many factors in the environment of modern aircraft have to be taken into account at one time that no single brain can completely analyse them. To name a few, free air static temperature, altitude, air density, mach and dynamic pressure as well as the performance of the plane have to be measured and integrated to gain the greatest efficiency and safety. No longer can a pilot fly by the seat of his pants—sometimes he is thrust out of his seat and many high speed planes are designed for the pilot to fly lying face down.

The result has been the development of a whole new range of measuring instruments that express their findings in terms of electrical voltages or pulses that can easily be handled by small electronic computers. It is only as a secondary consideration that the measurements need be indicated by dials. It is probable that the present, typical, complex array of instrument dials will disappear from the planes of the future with the routine work carried out by a small, black box containing pre-arranged taped instructions, a computer operated by press buttons.

The measuring instruments, the ears and eyes of the pilot or computer, are already being manufactured and are in use. They translate positioning or physical data automatically into electrical data and are known as transducers. They must be lightweight, rugged and dependable. A pressure ratio transducer operating with a pitot tube sounds complicated but, in fact, is a simple means of measuring the speed of an aircraft or rocket. Two tubes are placed in the air stream so that the difference in the pressure in them is proportional to the speed through the air. The pressures

Static Pressure Transducer Pressure Altitude



are fed to the transducer, where they act on a small, metal bellows and alter the position of a sprung beam. This

opens or closes two pairs of contacts operating a small electric motor that balances the arm between the contacts. In this way it is the number of turns made by the motor that operates a cam which drives small transmitters to furnish the necessary output to the computing network.

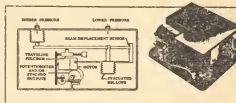
The complete unit weighs just over three pounds, can withstand shocks of up to 30 g and continuous accelerations of 10 g in any direction. Add to this the fact that it is accurate up to a height of twelve miles and between -55 and 80° C. and you can see that it is an instrument useful not only for pilot-carrying aircraft, but also for guided missiles and other atmospheric rockets.

Another transducer has been developed to indicate the direction of an air stream over a surface giving, say, the angle of the plane to the air flow. This merely consists of two similar slots in a movable head mounted so that when the head faces directly into the air stream there is no pressure difference across the slots. Any pressure difference causes the head to be moved by a motor or pneumatic system until the difference disappears, the angle through which it is turned directly giving the reading to a transmitter.

the same range of usefulness as the air speed indicator.

With the very high speeds now being reached by modern aircraft one of the

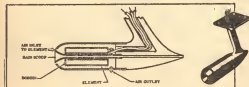
DESCRIPTION



main problems of design is the heat barrier, when the impact of the air on the surfaces raises their temperature to such an extent that the metal weakens. Another problem, not so well known, but directly connected with it, is the measurement of true air temperatures using high speed aircraft. It is no good sticking a thermometer out into the airstream; it just gets hot from the kinetic energy of the air molecules stopped by it. The problem was solved by using a total temperature transducer giving the stagnation temperature of the air. Air is bled into a small duct so arranged that any rain is scooped through a central channel, the relatively large rain drops not being able to make the relatively large direction change to get

into the duct. The air passes over a wire element whose electrical resistance changes with temperature and this resistance is automatically monitored and the results fed to the computer.

An acceleration transducer for practically any g range, vertical or horizontal, weighing only three quarters of a pound, is one of the simplest units. It is



Once again it is light, weighing only one and a half pounds, and can be fitted with internal heaters to prevent icing up at low temperatures and has

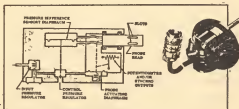
built round a sliding metal slug attached to a spring and sealed in a tube filled with a silicone damping fluid. As the spring is compressed or

Total Temperature Transducer
Total, or stagnation, temperature of ambient air at flight altitude in degrees Kelvin

expanded by changes in acceleration an arm attached to the end of it moves over a wound resistor so that the compression of the spring, and hence the acceleration, are indicated by the resistance of the resistor, giving a direct electrical reading. Simple, but effective.

ments in the field of transistors for tiny valves and printed circuits have cut the weight down enormously, whilst the use of magnetic storage drums and transistor memory frameworks means that where once a whole room was filled with the valves and memory of a moderate size computer

Airstream Direction Transducer
Local (indicated) angles of attack and yaw



Variations of these methods are used in other instruments. Altitude measurement is carried out by evaluating the air pressure using the movement of a sealed metal bellows attached to a resistor wiping arm. Another type of differential pressure transducer uses two metal bellows and a resistor so that the difference between the movement of the bellows is expressed as a change in the resistance. A vertical velocity transducer measures the rate of change of atmospheric pressure by finding the pressure difference across a constriction and a fixed volume vessel.

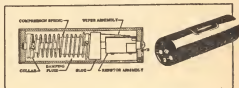
Combinations of these figures can be used to obtain other data and can be integrated with the results from other equipment such as radar, ground position indicators and fire and bomb sights. Many of the computers that do this are of the electromechanical type but the forerunners of the airborne digital computers are already in operation. The recent develop-

the same unit can be built into something a little larger than a suitcase,

But the important point is that these instruments are only the beginning. They are designed for use in the Earth's atmosphere, but the higher they are used the nearer their design must approach that which will be used outside the atmosphere. The small satellites that will orbit round the Earth in a few years time will contain instruments developed from these. Then the designers can really get down to the job of planning instruments to control spaceships. By then, perhaps, we won't need pilots.

Conforms to all environmental conditions where Spec. MIL-E-5272 is applicable.

Accelerometer
Vertical or horizontal accelerations



URANIUM

by W. W. BYFORD, B.Sc.

A REPORT IN GENEVA, dated August 8th, 1955, quotes the United States price for uranium metal as 40 dollars per kilogram, which works out roughly at ten shillings per ounce. To the chemist uranium is one of the most metallic of all metals. It readily combines with oxygen. At ordinary temperatures it rapidly oxidises, on the surface only, forming a tightly fitting skin of black oxide which shuts out air and prevents further oxidation, but when heated in air it burns brilliantly. If you hit it with anything hard enough to knock off small specks of uranium dust, these specks take fire. The metal displaces hydrogen from acids and will react with boiling water. All this is the chemical behaviour of those elements such as sodium, potassium, calcium

and magnesium which the chemist calls metals.

To the metallurgist the word metal has a rather different meaning. Sodium and calcium are soft, impermanent elements of no use for making durable objects. Uranium, on the other hand, behaves very much as a metallurgist thinks a metal should. Nevertheless, neither the chemist nor the metallurgist makes very much use of uranium as a metal, and the price quoted above is in no way due to the metallic properties of uranium.

Metals, of course, like all other elements, are composed of atoms. All the atoms which make up everything have a common pattern and are built up of the same kinds of smaller units. The chemical properties of a given element are due to the arrangement and number of electrons in its construction.

Every atom of uranium contains the same number of electrons as does every other atom of uranium and, therefore, all uranium behaves to the chemist in the same metallic fashion. Every uranium atom has in its nucleus a number of protons equal to the number of electrons present in the atom. The number of neutrons which complete the build-up of a uranium atom is not, however, always the same. All uranium atoms have 92 electrons and 92 protons, but some have more neutrons than others and are, therefore, slightly heavier. The heavier atoms are known as uranium 238 and the lighter ones are called uranium 235. Uranium produced by ordinary methods contains atoms of both kinds. And just how is uranium produced?

It all began in the year 1789 when Klaproth obtained a new substance from a shiny black mineral known as pitch blende which had hitherto been thought to be an ore of zinc or iron. He thought of this new substance as a new metal which was not fully

metallic and he gave it the name uranium to commemorate the discovery of the planet Uranus by Herschel in 1781. In 1842 it was discovered by Peligot that what Klaproth had called uranium was actually an oxide of uranium from which he proceeded to extract the true metal. Most of the metal produced today is made by the same fundamental process as that used by Peligot over a hundred years ago.

In view of the economic and possibly strategic importance of uranium in the near future, it is of interest to note just where uranium ores are to be found. Firstly, uranium is not one of the common elements to be found in the Earth's crust. It is estimated that for every million tons of total mineral there are about four tons of uranium. There are an awful lot of millions of tons of crust on the Earth and, therefore, several million tons of uranium, but not all of it is easily obtained. One of the oldest sources of pitch blende is in an area known as the Joachimstal, in those days part of Austro-Hungary and later Czechoslovakia. Ten tons

of pitch blende can contain as much as six tons of uranium.

Another mineral, known as carnotite, was previously used as the source of vanadium, but it also contains about 3 per cent. of uranium and is now a major source of this metal. Carnotite is found in the United States, particularly in Arizona, Colorado and Utah. Uranium is also obtained from phosphate ores found in the Belgian Congo. South Africa, Canada and the U.S.S.R. increasingly produce uranium, whilst the Australian Government, in 1953, guaranteed minimum prices for uranium-containing ore and thereby stimulated prospector geologists to a spate of activity which promises by its fruitful findings to place Australia among the leading producers of uranium. It is interesting to note that while the price offered for ore containing 10 per cent. of uranium was about £500 per ton, other prices were fixed for poorer ores, and the Australian Government offered £10 per ton for ore which contained as little as 5 lbs. weight of uranium in every ton.

It has been stated above that the chemist made very little use of uranium as a metal. One of the earliest minor uses was in one of the oldest of the chemist's arts, that of glass making, in which most metals have been used. In 1896 Becquerel made a startling discovery. He had placed a small quantity of a uranium compound on an unused photographic plate which was still wrapped in black paper. Subsequently he found that an impression had been recorded on the plate as though light had come through from the uranium. But obviously this was no ordinary light since it could penetrate black paper especially designed to shut out light. It was established that from uranium salts some kind of radiation was spontaneously given off which could penetrate all manner of substances through which light could not pass.

Marie and Pierre Curie set out to investigate this phenomenon in order to base upon it a thesis to present to the Sourbonne to qualify for a doctor's degree. To Madam

Curie must go the credit for realising that this new force, to which she gave the name of RADIOACTIVITY, was not a property of chemical compounds as such, but rather that it was due to the peculiar behaviour of individual atoms. Furthermore, she came to realise that in the uranium there must be a small trace of some hitherto unknown element and that it was the atoms of this element that were radioactive. If, then, she could separate this new element she would obtain a far more intense source of radioactivity. Pitch blende was then the only source of uranium, and because of its use in glass making, it was expensive, far too expensive for the limited purse of the Curies, who had impoverished themselves to gain a scientific education. But, they reasoned, if the element they were seeking was an impurity in uranium then it might be present in the rejected residues of pitch blende after the uranium had been extracted. They proceeded to ship ton after ton of this worthless waste to the little wood shed which con-

stituted their laboratory. For four years they fed this into an old iron stove and from it obtained two new elements, one of which had to be called radium, whilst the other was named polonium after Poland, the land of Marie's birth.

Radium proved to be all that the Curies had hoped, and its discovery earned them the Nobel Prize. It was present in pitch blende to the extent of one part in a million. It was found to be intensely radioactive, dangerously so when uncontrolled, but properly used, of therapeutic value. Chemically, radium is very much like calcium, the very common metal found in chalk.

This article began to be about uranium. Why, then, so much about radium? Well, firstly the world's uranium deposits began to be fully explored and exploited as a source of radium. Secondly, and more important, investigation of this revolutionary new form of energy produced by radium went full circle back to uranium as a source of energy.

By energy, of course, we

mean motion of that which has mass, or power to impart motion to that which has mass. The amount of energy in a moving body depends upon its mass (or less accurately, how heavy it is) and also upon the speed at which it is moving. Electrons have very little mass and when they leave atoms they do so comparatively slowly and so provide the comparatively low energies of electric currents. When, however, the protons or neutrons are lost by atoms, these comparatively heavy units come right out of the nucleus at very high speeds and so provide very much greater amounts of energy. If you think of an electron leaving an atom as a pea shot from a pea shooter, and then think of a fifteen inch shell leaving a gun with appropriate muzzle velocity, you've got something like the idea. It was soon realised that the atoms of radium shoot off their larger particles very rapidly but not very frequently. Radium is said to have a half-life of rather more than fifteen hundred years. This means that if we start with a given

weight of radium today, in the year 3,500 A.D. only about half the atoms present today will have shot their bolt and that in the year 5000 A.D. there will still be about a quarter of the original atoms not yet changed. Thus, the radioactivity of radium, although startlingly intense when discovered, was soon realised to be chick feed compared with the possibilities that will arise if some means could be found of inducing a sufficient number of atoms to discharge particles from their nuclei in a short enough space of time. It was found that no matter what you did to radium atoms you could neither speed up nor slow down the frequency with which they broke up. You could make a piece of radium very hot or very cold, you could subject it to very high pressure or put it in a vacuum, you could put it in strong light or keep it in the dark, but no matter what you did the atoms would still break down at the rate of fifty in every hundred in fifteen hundred years or so.

Then the daughter of the Curies, after Pierre had slipped

on a wet pavement and had been killed by a passing truck and Marie had died from over-exposure to radioactivity, observed radioactivity coming from a dirty test tube which, on investigation, revealed what is now known as artificial radioactivity. She discovered that many atoms not normally radioactive could absorb particles and become themselves radioactive. Moreover it was found that some of these atoms had much shorter half-life periods and new realms of new energies were opened up which even today we are only beginning to explore.

Now back to uranium. Remember the two kinds of atoms? Uranium 235 and 238. In a piece of uranium as obtained from pitch blende, of every thousand atoms nine hundred and ninety three are likely to be uranium 238 atoms and seven of them will be uranium 235 atoms. Now if a uranium 235 atom is hit in the nucleus with a neutron, it splits into two approximately equal halves and at the same time produces fresh neutrons. If the newly produced neu-

trons also strike the nuclei of two other uranium 235 atoms they also disintegrate. Thus it had been calculated before World War II began that if you could get enough uranium 235 atoms in one place to prevent the escape of neutrons, an enormous release of energy would be brought about instantly if any one nucleus were hit with a neutron. It was calculated that a sphere of uranium 235, eight feet in diameter and weighing far more than the biggest bomber could possibly lift, would do the trick. It was, however, found possible to reduce the size of the bomb by reducing the speed of the neutrons, and Hiroshima was the result. If that were all, the story of uranium would be, indeed, a sorry thing.

Fortunately, the world's physicists, mathematicians, chemists and engineers are being increasingly better employed. We are learning little by little to slow down, rather than speed up, the release of the energy in uranium 235 so that instead of rapid destructive expenditure we have steadily produced creative

power. Graphite moderates the velocity of neutrons. An "atomic pile" has been made with a mass of graphite penetrated by uranium rods. The rods contain a suitable proportion of uranium 238 to uranium 235 in order to prevent some of the neutrons released from splitting atoms, and thus the rate of reaction is slowed down to such an extent that heat is produced no more rapidly than it can be carried away by water. The heated water is a potential source of power. Remember uranium reacts with hot water and the rods must, therefore, be encased in aluminium. That was a simple solution to one of the simplest of the many difficulties which are being encountered. Even when a pile is reacting very slowly millions of millions of atoms are splitting every split second and the actual rate of heat production is predictable only in terms of an elaborate law of averages. Anyone who

has played pitch and toss or any other game of chance will know how freakish occasional freaks can be, and so an atomic pile will occasionally begin to produce heat much more quickly than it is designed to do. In other words, every now and then there will be too many neutrons running around. It has been found that the metal cadmium is an efficient absorber of neutrons, and from time to time it is necessary to insert cadmium rods to prevent the thing from getting out of control.

There are still many problems to be solved before the normal power plants of the world become obsolete, but 1955, with its interchange of know-how by the nations at Geneva, will doubtless prove to be a year of great significance in the full exploitation for the benefit of the peoples of the Earth of the power that lies in uranium.

INSPECTION INVITED

Review of a modern scientific aid to industry

THE JONES AND LAMSON OPTICAL comparator was developed just after the first world war and has been improved, streamlined, modernised and adapted to the exacting requirements of modern industry and is ready to forge ahead into the future where its unique advantages will be increasingly in demand.

Inspection of small forms of complex shape, such as components for cybernetic machines, radio-controlled servo-mechanisms and telecommunications, presents a formidable and time-consuming task if tackled by physical instrument measurement. Imagine checking a production batch of machine screws with micrometer pitch gauges! The Bench Type Optical Comparator is able to perform this inspection function at enormously increased rates.

There are various types of Optical Comparator, some designed for specific functions. They look something like an electron microscope, with a radar screen, turret-lathe control wheels and a trimming of futuristic unworldliness. Yet those unlikely features each perform a task which, added together, combine to give a precision machine which inspects and measures with speed and accuracy.

A concentrated, parallel beam of light is directed upon the part to be inspected. The resulting shadow is magnified by a lens system and projected upon a viewing screen by a mirror. Here, the enlarged shadow image can be inspected and measured easily and quickly by comparing it with a master chart or outline on the screen.

The ray of light falling on the part to be inspected is produced by a high intensity illuminating unit consisting of a lamp, a precision condensing

lens and usually a coloured filter. A cooling blower, located directly below the lamphouse, keeps the temperature of the lamphouse assembly normal and constant. If the beam of light were similar to that thrown by a torch, the resulting shadow would be useless for the high precision measurement necessary. Consequently, parallel light rays must be produced. This is done by having the light source at the principal focus of the condenser, and the axis of the condenser coincident with the axis of the projection beam.

These parallel rays of light strike the part to be inspected, which may be anything from tiny screw threads to razor blades, from transistors to turbine assemblies. Measurement as fine as one ten-thousandth of an inch can be easily made. The diversity of application is almost unlimited.

The shadow of the part under inspection is now enlarged. The "heart" of the Comparator, the projection lens unit, accepts the sharply defined shadow, and enlarges it to the desired magnification. Lens systems are fitted which magnify the shadows from 5 to 125 times the size of the parts being checked.

A commonly used degree of magnification is 62.5. This magnifies one thousandth of an inch up to one sixteenth of an inch. By using an ordinary ruler, you can measure on the screen a distance of one sixteenth of an inch and know that you are really measuring a distance of .001 inch. To achieve this high degree of accuracy the lenses must be near-perfect to assure a sharp, distortion-free shadow.

After leaving the projection lens unit the shadow, now magnified to known limits, reflects from the mirror. Painstaking polishing and grinding produce the mirrors used, their sur-

faces comparable with an optical flat—and within four or five light bands of being an optical flat itself. The mirror can be adjusted for various magnifications so that the reflected shadow is in perfect scale on the screen.

Lastly, the shadow impinges on the screen, which was likened to a radar-screen. The screen may be either clear glass or ground glass with precisely etched reference lines, usually horizontal and vertical lines and a sixty-degree line. Around the circumference of the screen is a graduated chart ring which enables the chart to be rotated by means of a vernier so that angular measurements of the shadow may be made.

The work to be inspected is held by various types of staging fixture which are controlled by micrometer adjustment. The part is placed into position and then handwheel, micrometer and vernier precisely align its shadow on

the screen with the master outline. Any deviation from standard is at once apparent.

When, on looking at the screen, what appears to be a range of saw-toothed mountains is seen, whereas in fact they are the threads on a tiny screw, the versatility and value of the Comparator are readily understandable.

The Optical Comparator has made possible a method whereby the size, shape and fit of a part may be *seen* rather than *felt* as is true with most mechanical gauges.

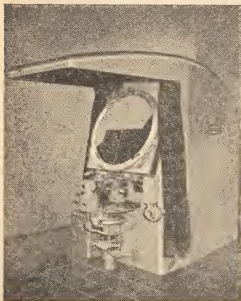
With present-day demands upon science of absolute accuracy and dependability in the productions for everyday life of the results of laboratory research, science must be able to assure users that their tools and equipment will not fail or break-down. For the sake of a nail, a horse was lost, for the sake of a horse a battle was lost.

It is incumbent upon scientists that there shall be no chance whatsoever that, for the sake of a component a spaceship was lost.

To fulfil rigorous inspection standards of small parts with easily outlined and shadowed contours is relatively easy. But how to project a shadow of a tool which has a cavity or groove which must be precisely machined to very fine tolerances?

The method adopted is a triumph for the ingenuity of the whole Optical Comparator method. Where direct projection through the optical system is impracticable, such as the recessed contours of dies and moulds, some internal surfaces such as grooves, a ball bearing tracing attachment is brought into use.

The attachment consists



of a co-ordinate slide that gives congruent or corresponding paths to two synchronised carbide tipped styli connected to the slide by an arm or arms, dependent upon the nature of the inspection. One stylus traces the contours being inspected, the other stylus duplicates the movements of the tracer in the focal plane between the light source and projection lens. Its magnified shadow is projected upon the viewing screen and its movements outlines the shape of the cavity being inspected against a master outline on the screen.

One of the most important factors in efficient production is a current, day-to-day knowledge of the condition of the machine tools of production. If a machine is allowed to go on turning out parts when the machine itself is deteriorating, then, automatically, the production lot will be sub-standard. This is particularly shown in tip condition of high speed cutting tools.

With the Optical Comparator it is possible to observe the tip condition of tools easily, seeing just how much wear they have sustained, how that wear was acquired and whether any improvements for the next production batch can be made. The reflection attachment is brought into operation and on the screen is shown a blown-up image of the tool, with the marks of its work plain upon it.

A combination holder for use on the screen can provide photographs of the enlarged shadows, or of the reflected images of parts, for permanent record. This feature is particularly valuable where records must be sent from one laboratory to another—instead of sending the actual part, a film sequence is posted off which tells the whole story!



Double exposures are possible. Thus the threaded cap of a bottle can be shown against the bottle top, from which, knowing the thickness of the metal in the cap, the contact of cap and bottle can readily be established.

Coupled with the ability to measure in ten thousandths of an inch, and to record those measurements, the Comparator's proved versatility was an obvious necessity when the question of jet-engines began to take on complexities undreamt of even twenty years ago.

A special Optical Comparator was built, incorporating all the proved devices already known into one instrument. The turbine discs fresh from production are lowered onto the work table by electrically powered hoists and a complete check can be carried out by one operator. Any deviation from specification is at once apparent and the production machines may be corrected at once.

Photos: Jones & Lamson

Modern Alchemy

FROM THE UNIVERSITY OF California comes the news that yet another new element has been synthesised by nuclear physicists, the modern equivalent of alchemists. Using a giant 60-inch cyclotron instead of a cauldron, the transmutation resulted in element 101, never before identified.

This is the ninth element above uranium to be synthesised in cyclotrons or nuclear piles. It has been named mendelevium, symbol Mv , after the Russian chemist Mendeleev. It was Mendeleev who, in 1869, was the first scientist to predict the properties of such an element as the then unknown germanium. He did this by means of the periodic table, listing the known elements in groups according to their chemical properties.

Such is the accuracy of modern physical techniques for analysing radio-active materials that only 17 atoms of mendelevium were actually

identified. And these were obtained in the course of eight experiments. The chemical properties of mendelevium were predicted from the properties of its precursors in the periodic table and it was found possible, from the 17 atoms identified, not only to check that these predictions were correct, but to roughly calculate the half life of the element.

As expected, it is an unstable, rare earth type of element with an atomic weight of 256. It is believed to have an isotope, even more unstable, of atomic weight 255. The element that was created had a half-life of about only an hour, so speed is essential in its preparation and analysis, otherwise there is soon little left to study. It is no good going off to lunch in the middle of its analysis; most of it will have disintegrated by the time that you get back.

It spontaneously divides into two parts of approximately equal mass and has the

shortest half-life of any element known to decay in this manner.

Mendelevium was made by exposing a very thin film of the synthetic element number 99 to an intense beam of fast-moving alpha particles, helium nuclei, in the cyclotron. The specimen of element 99 was electroplated from solution onto a small piece of gold foil which was placed in the beam. It was so arranged that the transmutation of 99 into 101, which resulted in enough energy and recoil to shoot the 101 atoms off the foil, also automatically separated the atoms. Another piece of gold foil was placed very near the first one so that the atoms of the new element collided and stuck to it.

This sheet of gold was dissolved in acid and quickly separated into the various fractions which should contain the different elements. When each was tested for radioactivity it was found that the solution that should contain element 101 gave a few tremendous pulses of energy that could have only come from fissioning atoms. Further work conclusively proved that here was a new element.

At the moment, there appears to be no use in any practical sphere for mendelevium. It cannot be used in nuclear weapons or as an energy source, and its study is very much pure research—research aimed at extending our knowledge of the constitution of matter and energy.

With nine elements heavier than uranium already synthesised the question arises whether or not there is a limit to the number that can be made. The transuranic elements, as these are called, become more and more unstable as their nuclei become heavier and more complex. The list of them, in order of atomic number, runs from neptunium through plutonium, americium, curium, berkelium, californium, 99, 100 to mendelevium.

Of the last three, 99^{253} has a half-life of twenty days, 100^{256} has a half-life of three hours and divides into roughly equal parts whilst mendelevium has a half-life of between half an hour and two hours.

If the still higher transuranic elements can be made it is probable that their half-lives will be so short that it will be difficult to prove that they have been formed.

Most of the transuranic elements have been made in nuclear piles by cooking them in an atmosphere of neutrons. Ninety-nine and 100 were made by a series of neutron captures and radioactive electron emission, but this cannot be carried out above 100 because the latter spontaneously fissions before there is a chance of it further reacting with more neutrons.

It should be possible to make the even numbered ones such as elements 102 and 104 by bombarding heavy atoms with the ions of moderate sized atoms. One hundred was made by bombarding uranium with oxygen ions in some recent experiments, and it should be that using plutonium instead of uranium will give 102, whilst curium should give 104.

Apart from the difficulty of

their short half-lives there will be the problem of the intense radioactivity of both plutonium and curium. Special precaution will have to be taken whilst handling them as target materials in a cyclotron—and intense radio activity does not easily allow the use of the high speed methods of analysis essential for these elusive atoms.

Elements 102 and 103 should also have rare earth type properties, but at 104 there should be a complete change in the series so that 104 is similar to zirconium. Whether or not this is so can only be proved by synthesising these new elements and developing newer and faster methods of analysis based on nuclear techniques rather than the older and slower methods formerly used in chemistry.

NEXT MONTH'S ISSUE

Final instalment of J. T. McIntosh's *The Lady and the Bull*. Other stories by E. C. Tubb, Jonathan Burke, A. G. Williamson, John Kippax. Usual popular illustrated science features.

AUTHENTIC—A MONTHLY MUST!

The man who said XIIPXERTILLY

BY DON CARRIWAY

LIVING IN BED IN THE MENTAL observation ward of a prominent London hospital, Henry Green reflected that it all began when he said "XIIPXERTILLY"—on the No. 69 'bus, that is. He hadn't intended to say it—heavens, no. As a matter of fact, Green had been indulging in his favourite daydreams of new and more fantastic spaceships. Perhaps working in Menger's toy factory designing "Captain Zoom" spacesuits and accessories accounted for his unusual train of thought.

The conductor had approached him as usual, requested his fare, and stood flabbergasted when Henry said it: "XIIPXERTILLY."

Apart from an uncollected fare and an irate, if mystified conductor, nothing came of his phenomenal reply. Trouble was—he couldn't say anything else. Naturally, his venom-tongued wife made the time-honoured accusation, to which a bored Henry silently answered by producing an unopened packet of mint sweets.

Twelve hours of "XIIPXERTILLY" drove Mrs. Green to the edge of despair, and 10 a.m. next morning saw Henry sitting on a hard bench in the Psychopathic ward of the nearest hospital, awaiting examination.

Smiling ruefully, Green recollected the sensation he had caused. Five doctors had peered, poked, patted, pulled, parted and pestered his personage in a grim endeavour to bear out the stolid factual background of their scientific training.

The old stand-by of the industrial grades "occupational disease" was introduced to his file documents, and the new guinea-pig had to suffer the sight of the doctors crawling, running and posturing with toy jet-planes, trying to coax his mind back to

normal channels—as if it had ever left.

The click clack of the night nurse's heels crossing the ward floor roused him from his reverie, and Henry idly glanced up as she approached his bed. His eyes narrowed in fear, when he noticed her oriental eyes, surmounted by sweeping black eyebrows, and the mysterious green glow emanating from her elfin features.

She stopped at his bedside, took his pulse rate and entered details on his chart without speaking. Clipping her pen in her uniform pocket, she turned towards him and spoke.

"XIIPXERTILLY."

"MIXPEREP," he replied.

To his amazement Henry found himself answering her queries in the strange language. Apparently, she was a secret agent from the planet Melcrudium, and had been sent in hot pursuit of a revolutionist who had kidnapped the Planet Director, and set off for Earth in his spaceship.

Headquarters on Melcrudium sent out thought transference messages in code every twelve hours to the secret agent nurse. Green, obsessed with space travel, had picked up the thought transference message by mistake. After he delivered the gist of the communications the nurse told him that he would be able to converse in English after she had completed her mission.

"XPXREZIPLY," Green exclaimed, which, freely translated from Melcrudian, meant: "Strewth, now I won't be able to tell the wife to close her yap."

He had visions of his spouse bending over his hospital bed, wildly waving her umbrella, and accusing him of misbehaving with the entire nursing staff in the hospital—not without reason either.

With a curt "ZUXTIPUT" in farewell, the strange nurse slipped silently from his bedside. Henry lay back on his pillows, his thoughts chasing rapidly through his brain, until exhaustion took its toll, and he drifted off uncomfortably into sleep.

The clatter of brushes and pails made him start up in bed, hollow-eyed, after a restless night. A long claw-like hand appeared in the doorway, gripping the ear of a shuffling dejected figure, carrying washing implements. The body of the aggressor came into view, and a pair of blazing eyes, set in a square, sharp-featured face demanded Henry's attention.

"We come clean your room," he said, his mouth pronouncing the words in a guttural manner, with difficulty. "I spik for Willie the dumbie here—no ask him questions." To further his remarks he gave his companion's ear another cruel twist. "We start work now?"

Henry nodded his head wearily in assent, and lay back, closing his eyes. An hour later his worst fears were realised. His wife had arrived in full battle array. A resigned expression flitted across his face, as she began her tirade of uncomplimentary remarks. Finally, after developing a fine advertisement for cough cures, she left her husband to his own devices.

A few minutes later, the Melcrudian nurse appeared, bereft of her green glow (owing to double summer time) and informed him that the revolutionist was reported to be in the vicinity.

Under the bed, slopping suds over the floor, the subject in question grinned fiercely, and waited for his opportunity to wrest the Melcrudian messages from Green.

Meanwhile, Mrs. Green, stationed at the hospital entrance, spitefully glanced after the departing night nurse, who she suspected was leading her dutiful husband astray. She made a mental note to wait outside the Nurses' Home in the evening and follow the nurse to her rendezvous

with her "dear 'Energy"—the beastly little two-timer.

The revolutionist straightened his aching back, closed the ward door, and advanced menacingly towards the patient, who drew up the sheets to his neck in terror.

"XIIPXERTILLY." The word had an immediate chilling effect on Henry's spine, and he shivered with fright. A minute later, it was made apparent the cleaner was, in fact, the kidnapper and his clumsy assistant—the pitiful drugged being—was the Planet Director. With a flick of his wrist, the stranger quickly produced a snub-nosed pistol, which made Henry's spirits sink even lower.

Unexpectedly, the ward door burst open, and the night nurse strode purposefully into the centre of the room. She firmly gripped a strange black object, which she carefully pointed towards the would-be killer.

Quaking with fear, the Melcrudian revolutionist dropped his pistol, shrieking that the nurse held a dis-integration ray gun, and turning to escape—promptly disappeared. Henry gulped, and noticed the faint burn mark on the wall, and the nurse's tightly-clenched hand on the ray gun's long trigger.

Hustling the Planet Director from the room, the Melcrudian Agent winked encouragingly as she locked the ward door. The quick succession of events had tried Green's nerves, and licking his lips, he opened his mouth.

"H E L P-P-P"—this in perfect English. Meanwhile, Mrs. Green was tiptoeing along the small grassy path from the hospital to Baleston Heath, following the mysterious nurse and her stumbling companion. Stopping for a second, she thought she heard a peculiar whirring noise, but dismissed it from her mind, and continued following her quarry . . .

A few hours saw Green, now in full possession of his faculties, eagerly striding up the road to his bungalow

Continued On Page 129

First instalment of an exciting new
two-part serial

The Lady and the Bull

by J. T. McIntosh

SILENCE, AND CAMISAC'S third moon rising to make the clear patches as bright as day, while the shadows under the trees and among the thick bushes remained inky black. A rustling, not of a breeze but of something moving in the undergrowth. Then a patter of quick steps. A girl bursting out into the open, a girl in a long, trailing white dress which streamed out behind her as she ran. A man's voice, far behind, shouting.

An old story. A story older than history.

The girl paused for a moment, panting, and wrenched fiercely at the long train of her dress. It tore raggedly, leaving long strips

hanging, but now her legs were free, and when she broke into a run again she covered the ground like a deer.

The man chasing her crossed the clearing thirty seconds after her. He was drunk and he was an athlete—the way he ran made both facts clear. Drunk, he was still a little faster than the girl. He was staring ahead, pausing occasionally and then darting forward again as he caught a glimpse of white ahead of him. He was laughing as he ran.

The girl in front turned off the path, darted along a broad, natural avenue among the trees, and suddenly found her way blocked. There were

thick bushes on three sides, bushes she couldn't force her way through.

And her pursuer was charging triumphantly along the avenue of trees, now spotlighted by bright moonlight, now invisible in black shadow.

Trapped, the girl waited calmly enough, though gulping for air. She brushed back her black hair and licked a long scratch on one forearm.

"I'll say this for you, Nila, you can run," the man panted as he came up. "I thought for a while you were going to—no, you don't!"

He caught her arm as she tried to dart past him. He pulled her close and crushed her against him.

Then he yelled with pain. She had kicked him savagely on the ankle. The yell was cut short as Nila kneed him violently and skilfully in the stomach, tripped him, dropped on top of him, seized his head and battered it on the ground till he was dazed and helpless.

Nila stood up. She stood looking down at him, a small but very fierce figure, suddenly and obviously not nearly as

helpless and defenceless as she looked.

"I suppose it didn't occur to you, Eric," she observed, "that I ran away because I didn't want to hurt you?"

He heard that, but he didn't see her go. There was no sign of her when he staggered to his feet, sore, much sobered, very sorry for himself and even denied the satisfaction—for he was essentially fair-minded—of cursing the person who had done this to him. He had got what he asked for.

What he didn't know was that Nila was quite capable of handing it out. He knew now. The brisk competence with which she had handled him was almost indecent, he reflected indignantly.

Half an hour later, Nila was telling Farley: "I'll be able to deal with Eric Sturt all right. But I keep telling you it won't do any good."

"What do you mean—you'll be able to deal with Eric Sturt all right?" Farley asked. "What can you do with him?"

"Whatever you want me to do with him," said Nila

innocently. "But what difference is it going to make, anyway? Camisac and you are finished, Big, and you know it."

Farley merely shook his head. There was more determination in that answer than if he had shouted "No!" half a dozen times.

One could see at a glance that Farley would never be finished. Or if he was, he would never admit it.

Lady Hilda reached absently for an underwater temperature control which wasn't there. When she failed to find it she womanfully resisted the temptation to sigh for the little luxuries of Cosmopolis and mentally write Camisac off as backward and primitive. Lady Hilda's life was an anthology of temptations resisted.

The absence of the heat control meant that for almost the first time since she had acquired the habit, twenty years before, she wouldn't be able to remain luxuriously in her bath until she was good and ready to leave it. She

was going to be forced by the gradually increasing chill to get out and dry herself, unsatisfied, like a diner hustled from the dining room with the soup plates.

She permitted herself to regret the unfortunate circumstance, but not to resent it. Resenting a thing like that was like resenting a mountain in one's path. Lady Hilda had never allowed herself to resent mountains.

The door of the bathroom opened and Nila came in. This time Lady Hilda did sigh.

"If only as a personal favour, Nila," she said, "won't you please knock in future?"

Nila shrugged. "Seems silly. I was coming in, anyway. Mr. Sturt wants to see you."

Hilda smiled faintly. "I think he would prefer it if you called him Eric, Nila," she said.

"Not this morning," said Nila definitely. "We're being very formal—Mr. Sturt and Miss Ferrari."

"This morning? What happened last night?"

"Nothing," said Nila beligerently. "*I* saw to that. It wasn't his fault that nothing happened—the rat. Well, are you going to see him?"

"I can't see him right now."

"Didn't think you would, or I'd have shown him right in."

Lady Hilda sighed again. Nila, like so many of these extra-Cosmopolitan people, was regrettably Earthy at times. Calling a spade a spade was excellent, but there was no need to call it a bloody shovel.

"That remark was hardly necessary, Nila, was it?" Lady Hilda asked mildly.

"I suppose not," Nila admitted. "You can't possibly be his mistress or he wouldn't be chasing me so——"

"*Please*, Nila," Lady Hilda begged.

"Oh, well. I told you Sturt was here. What you do about that, if anything, is your affair." And she shut the door behind her.

Nila, though trying, didn't deliberately set herself out to be as annoying as possible, Lady Hilda told herself—

being fair, as usual. Nila treated everyone else the same way, and the way they treated her in return showed that she must be fundamentally good-natured. Only fundamentally could mean buried deep.

Dismissing Eric from her mind, Hilda tried to enjoy the last few moments of comfortable, relaxing warmth. She found it impossible. The knowledge that she would soon be forced to get out and dry herself ruined the sensation of lassitude which was the essence of civilised bathing.

So, with something of the grim resolution of her ancestors—the ancestors whose deeds had given her the right to be called Lady Hilda—she stepped out of the bath and began to towel herself, refusing even to think of warm air drying blasts or automatic clothing dispensers.

She also needed a certain resolution to look at herself in the mirror. She had never been beautiful, and she knew it. Nevertheless, until quite recently it had been a pleasure to look at herself in a mirror.

She had regular, pleasing, graceful features and her body was slim and firm. And until quite recently she had seen, when she looked in a full-length mirror like this one, a woman who was to all intents and purposes eighteen. But now, at thirty-four, there was a tiny, subtle, but quite noticeable difference. She would be much as she was now for more than twenty years yet; nevertheless, she was on the threshold of being called an attractive woman instead of a pretty girl, and that was a threshold which no woman wanted to cross, not even Lady Hilda.

However, that was like the mountain which she refused to resent. She was losing the fresh bloom of youth, and there was nothing she could do about it. The civilised thing to do was be glad she was at last mature, instead of trying to pretend the last sixteen years of her life didn't exist and she was still a young girl.

She didn't go through to her room until she had wrapped herself in a dressing gown, pulling the top much

closer than it was meant to lie. Eric Sturt was a distant relative of hers, an attractive, likeable young man, the only other Cosmopolitan on Camisac, the only person within light-years to whom she could talk freely—but a subordinate on a job. It was a strict rule that their relations while they were on a business trip, though hardly formal, should never become too familiar.

Lady Hilda waved Eric to sit down, sat before the mirror of her dressing table and began to comb her hair.

"I've completed the preliminary survey of Camisac, Hilda," Eric said. "There's no doubt at all that the colony must be abandoned. The cost of working and transporting metals is much greater than their value to us. And the other considerations I've taken into account don't do much to redress the balance."

"But of course this is only a preliminary survey," Hilda murmured.

Eric shook his head positively. "There isn't—there can't be—anything left to

find that will make any significant difference. I'm prepared to tell Farley now what I've told you."

Hilda might have pointed out, but didn't, that it wasn't Eric's responsibility to decide what and when Farley should be told. She never made needless displays of authority.

"The Premier is going to be difficult," she observed, still combing her hair.

Eric frowned slightly. She saw his frown in the mirror. Eric never called Farley the Premier. He didn't like to admit, even in that way, that Farley was important. Eric was prejudiced—Hilda had to make sure that she was not. It was things like that which made the difference between commander and subordinate—between administrator and mere assistant.

"Farley's point of view on this," Eric said shortly, "is unimportant. We aren't really interfering with his job, his world and his people. Our concern is merely whether Centre continues to support Camisac or not."

That really merited a reproof. It wasn't up to Eric

to say what their concern was. However, Hilda allowed for his youth and impulsiveness, and let it go.

Eric was twenty-three. He was primarily a statistician, but he also had certain qualifications as a psychologist, sociologist and diplomat. At least, he was supposed to have. Hilda was not so sure. When one said a person was a good psychologist, one generally meant that he was good at understanding people, not that he knew a lot of facts on the subject. And a good diplomat wasn't a trained calculator; he was a man who could get different groups with different interests to agree.

Eric was tall, slender, and quite startlingly handsome. It often happened like that in noble families, Hilda reflected—the women were graceful and regal, but not beautiful, while the men got all the dash and beauty that was going. It also happened very often that the women of a ruling class supplied the calm and shrewdness to offset the impulsiveness of the men.

"Farley may wish to carry

on without Centre's support," she remarked.

Eric grunted. "I haven't a doubt of it," he declared. "Farley's a bull, and he goes at things like a bull. He doesn't think, he merely reacts."

"I don't think you should have said that, Eric," said Hilda mildly.

"I'm sure I shouldn't have said it. Perhaps I shouldn't have noticed it, either?"

There was a perceptible drop in the temperature when Hilda spoke again. "You've a lot to learn, Eric. Including quite a few things about me. I permit a good deal, but there are limits. And too often you come too near the edge."

Eric shrugged. Hilda turned abruptly and faced him. "Don't force me to show I mean what I say," she said sharply. "I could send you back now—immediately. We'd both regret that. You'd resent it, but you'd also wish you hadn't said the things that caused it. And I'd feel that it wouldn't have been necessary if I'd made

my position clear earlier. I'm responsible for what's done here, Eric, not you. You're responsible only for the correctness of the information you give me."

Eric stared back at her, clearly rather at a loss. He didn't know how to apologise or withdraw gracefully.

Hilda waited just long enough for him to see how awkward things could be between them if she cared to make them so. Then she said: "We'll leave it at that, shall we?"

And when she spoke again it was in a lighter tone. "What's this I hear about Nila and you?"

Eric started violently. "What did Nila tell you?" he asked defensively, like a schoolboy ready to deny everything but not sure yet what the charge was.

"I got the impression she had to fight for her honour," said Lady Hilda, amused.

Reassured by her attitude, Eric admitted it. "But you needn't take her part," he said. "She doesn't need anyone to look after her."

"I gathered that. Poor Eric. Incidentally, did the thought of marrying her ever enter your head?"

"Marrying her?" Eric echoed, in a tone which showed it hadn't.

Hilda mentally summed up Nila, not much more than half her age, exquisitely pretty, smart, efficient, self-assertive, ambitious and probably quite amoral.

"Never mind," Hilda murmured. "When she wants you to think of it, you will."

Farley, frowning over the papers in front of him, relaxed a little as Nila came in. But he stiffened again at Nila's first question.

"Why are they going to close Camisac down, Big?" she demanded.

"How do you know they're going to——" he began, but she interrupted sharply:

"Don't stall. Obviously Lady Hilda's going to have Camisac evacuated, because it isn't doing well. And obviously, to someone who really knows what's going on here, Camisac *is* doing well. What's the answer?"

Farley was over seventeen stone, and not particularly tall. He wasn't fat either. He had vast bones and vast muscles, giving him strength which would have been very useful in a circus but which some people didn't think was the best qualification for Premiership. He was ponderous in thought as in movement. After Nila had finished speaking there was a long pause in which Farley's expression didn't change at all. If he didn't betray high intelligence, he didn't betray anything else.

"They came at a bad time," he said, at last.

"You mean, at a time when you'd been too greedy and hadn't been satisfied with the usual annual rake-off."

The shrewd, defiant way she threw that at him showed it was merely a guess. Farley was too slow to be bluffed into anything.

"If you call me a swindler again," he said warningly, "I'll put you over my knee and——"

"I know, I know. Though frankly, Big, I'm not sure you've any rights over me.

As I grow up and look at you I feel surer and surer that I must be Joe Ferrari's legitimate daughter."

Farley nodded, relaxing. "Maybe so." He was willing enough to pursue that topic, since it wasn't the other one. "Nevertheless, Nila, when Joe was killed——"

Nila snorted derisively. "I can read you like a book, Big. You don't want to talk about Lady Hilda and Camisac. You know I'd worm the truth out of you in five minutes. All right, I'll leave you alone—because maybe the less I know, the better. But I hope you can work something out. I'd hate to see Camisac ruined just because you'd been too greedy."

She was gone, with the swirl of long skirt which was so typical of her. When she had put up her hair she had taken to long skirts, and had worn them ever since. She said it was fun having men wondering whether she had nice legs or not, and nobody knowing.

She was quite right about Camisac, of course. Being in

a position to feather his nest, Farley had done it. It was simple enough—everything balanced, no unexplained items, but Camisac as an economic proposition appearing much worse than it was, if anyone cared to look. There had been no hint that anyone would care.

Farley didn't regret the embezzlement, though it would never have happened if he had guessed what might come of it. He hadn't stolen from Camisac, but from Cosmopolis, from Centre. He didn't even think about that.

He loved Camisac. At least, he had strong protective feelings for Camisac; he would never have attempted to define them. Had his temperament been different, and his feelings the same, he would have cursed himself for ruining Camisac. After all, that was what he had done. Unless he cared to confess everything, he had to let the Administrator, Lady Hilda, believe the evidence in front of her and evacuate the planet. Could Wyger do anything, he wondered.

Should he talk the matter over frankly with Wyger?

Nila popped her head round the door again. "Know what Eric thinks of you?" she asked impishly.

"He wouldn't tell you what he really thought."

"Think I'm fool enough to go by what he tells me? He thinks you're a bull. Stupid, obstinate, muddle-headed, liable to go berserk——"

Like Lady Hilda, Farley tried not to be angry, but unlike Lady Hilda he was completely unsuccessful. His massive face went purple. "Bull, am I?" he exclaimed, a muted roar. "Stupid, am I?"

"Well, I must admit," Nila observed, surveying him critically, "I can see where Eric gets the idea."

She shut the door behind her without giving Farley an opportunity to answer.

Still breathing hard, Farley forced his thoughts back to the main issue. *He would not give in to Centre.* He wasn't concerned over the rights and wrongs of the matter. He would fight. He would

fight Lady Hilda and Eric and Cosmopolis and Centre and the whole . . .

Bull. Stupid, obstinate, muddle-headed.

Farley tried to remember what Cosmopolis was like. He had been there as a boy of eighteen, twenty years before. Cosmopolis was too big to change much in twenty years. Centre was self-supporting as far as food was concerned, and half the agricultural land on the planet went to feed Cosmopolis alone. Its population ran into so many millions that the figure defied the imagination. The kind of fact which gave some idea of the immensity of the place was that Cosmopolis had seventeen levels of government, from the Hundred which ruled the galaxy down to the local committees which looked after a mere twenty thousand people. Or that there were so many streets the planners had given up trying to find a new name for each, and there were forty-three Main Streets, seventy High Streets, seventeen Madison Avenues and even a dozen Orchard

Lanes, all designated by their postal districts. Then there was the fact that though Buddhism was almost dead, with the disappearance of the races who had worshipped Buddha, there were sixty Buddhist temples in the city. And there was that TV game in which an imaginary person was specified—height, weight, age, sex, job, recreations, colour of hair and eyes and Christian name—and within a few minutes someone was found in Cosmopolis who fulfilled all the specifications.

No, you couldn't fight Cosmopolis, any more than you could stop a locomotive. That was out. And to all intents and purposes Lady Hilda and Eric Sturt were Cosmopolis.

What would happen was that Lady Hilda would decide Camisac wasn't worth maintaining, and the trading ships would stop coming. Whether Farley and his people—seventeen million of them—decided to stay where they were or not was a matter of very little importance. Nobody could be forced to stay, not in the face of

Cosmopolis, and right away ten million would go. In a few months, as things got harder, with Cosmopolitan subsidy and support gone, five million more would follow.

And, gradually, Camisac would bleed to death. That was what Cosmopolis, in the presence of Lady Hilda and Eric, was doing—cutting a vein. Camisac couldn't stop the bleeding. No matter how attractive life on the planet was made, the situation would be the same. The people of Camisac would be hermits living outside a glorious city, a city which would welcome them in but not go out to them. Gradually, hermit by hermit, Camisac would weaken and die. The cycle would be—civilised world, small settlement, tiny outpost, empty world.

That sort of thing was happening all over the galaxy.

There was no war, no break-up, no decadence, no scientific decline. Just, perhaps, a certain tiredness, a certain realisation that all this pressing outwards, ever outwards, wasn't worth it and

was not in the least necessary. Centre had ruled six thousand worlds. Now it ruled two thousand. Soon there would be less than a thousand.

Farley hoisted himself to his feet. He had to be careful how he used his immense physical strength inside a house. He was like a liner which had to be jockeyed out in the open by tugs before she could unleash her ponderous strength.

He would go and see Lady Hilda and have it out with her. At least she would talk to him. Bull, was he? He remembered half a dozen figurative phrases. Bull in a china-shop. Taking a bull by the horns. Bull at a gate. Bull-headed.

Maybe Eric was right. It had been by acting like a bull that he, Arthur Farley, without noble blood, high intelligence, talent, influence or any special qualifications, had charged his way to the position of Premier of Camisac at thirty-eight. It was too late to start acting like a snake or a fox now.

Out in the open, free of the

house, he charged across the courtyard between the Villa and the visitors' Pavilion. His foot caught a loose stone, and instead of tripping him it clattered violently across the stone flags. He didn't even notice the flagstones trembling and shuddering beneath him.

Farley didn't knock, didn't even think of knocking. Eric was lounging at the window. Lady Hilda was at the dressing table.

Farley stopped short. "Oh," he growled. "I didn't know you two were on these terms."

"What terms?" Eric demanded sharply.

Hilda, however, knew better than to allow herself to be put on the defensive. "Don't you ever knock, Premier?" she asked acidly.

"I would have if I'd known." He surveyed her negligee with deliberate rudeness.

"And I'd have said 'Come in.' If you're trying to offend me, Premier, please say so. Then we shall all know where we stand."

Farley hesitated. Deep in him there was a grudging admiration for Lady Hilda, composed of a dozen different things. She was a noble, after all, and he respected nobility. And he liked the way she was obviously determined to be fair, checking him and Eric impartially whenever either of them showed any antagonism towards the other. Also, never having had the capacity to match his manner to other people's, he admired the way she could adapt herself and reach an understanding with so many different people.

There was one other thing which made him admire Lady Hilda. He didn't know she wasn't beautiful. He thought she was. He thought she was one of the most beautiful women he had ever seen.

"It's of no importance, anyway," he grunted. "But I do want to know how I stand on another matter. Is Cosmopolis going to pull out of Camisac?"

"Yes," said Eric, with unconcealed satisfaction.

Hilda shot at him a glance laden with such cold fury that

even Farley was startled. "That shouldn't have been said," she told Farley. "Nevertheless, in essence, it is correct."

"Why?" asked Farley bluntly, looking straight at Hilda. He wasn't interested in Eric. Eric didn't count.

"The reasons will be stated in detail, and you'll have an opportunity to examine and discuss them. However, if you want them informally, they are as you no doubt guess. Camisac isn't paying its way."

Farley opened his mouth to protest, and shut it again as Lady Hilda went on quietly: "Cosmopolis really is impartial, Premier. It isn't everything for the benefit of Cosmopolis, but everything for the benefit of the whole. And it's on that basis that Camisac isn't a good economic proposition. If the mines here are no longer worked and there are no more food exports, Rogosto will have to be developed as an agricultural planet and the metals of Ternery will be exploited. It's on that basis that we've reached our conclusion.

Naturally, Rogosto and Ternery will be pleased—you're displeased. If the circumstances had been different, we might have abandoned Rogosto and Ternery, with corresponding expansion here. You see, it all depends——"

"I see. I suppose you know that Rogosto and Ternery and Camisac don't give a damn for Cosmopolis or the benefit of the whole or any other reasons you can give?"

Lady Hilda shrugged away the irrelevance.

"Suppose we refuse to be evacuated?" Farley said beligerently.

He knew the answer perfectly well, and Lady Hilda patiently explained exactly what he did know. No force was involved, except that Farley as Premier would be forced to give his people a free choice—a really free choice. The result, with Centre's support removed, was inevitable.

Watching him, Hilda could sympathise with him and his point of view, though she made no admission of it. Here was a man to whom it

was natural and inevitable to fight when he was attacked. As a pioneer, three thousand years before, he would have been indefatigable—and immensely valuable. Three thousand years ago he would have been a man forced by his character, temperament and abilities to go down in history as important, as a hero, as a leader. His children would have been—well, nobility and royalty were silly, empty words, going out of fashion. But Farley's children would have been privileged—as Lady Hilda herself was privileged, because a few thousand years before her ancestors had carved out new worlds for themselves from an almost virgin galaxy.

She appreciated the irony of the situation completely. The right man at the right time was a hero, feted for ever. The right man at the wrong time was an embarrassment, a failure, a thorough nuisance to everyone concerned.

Now Farley couldn't fight. It was a case of the irresistible force against the not-quite-immovable object.

She saw him bow his head, recognising this, and felt a kindly desire to coat the pill a little. She told him about compensation, about the generous arrangements which would be made for all the people from Camisac, about the excellent prospects which would be offered to him personally. When she saw that he wasn't interested, she tried to explain the general situation, so that he wouldn't feel the frustration of seeing all he had built up knocked down without even knowing why.

"Exploration goes in waves," she said. "A few thousand years ago, on Earth, people knew all there was to know about their world, or thought they did, and wanted to press outward. They colonised the system, all that could be colonised, and for a while that was that. There was even a period not unlike this, when useless colonies on satellites and asteroids were abandoned.

"Then it was the stars that mankind wanted. One after another planets were found and colonised—until, after hundreds of years, there

were over six thousand of them.

"No we're consolidating again. It has to happen sometimes. Men can't always be spreading outwards for no other reason than that they're restless. At the moment, we're a little tired, Premier. It's not decadence. It's just that the first flush of enthusiasm has gone. Every new world is very like one we know already—or if it isn't, it isn't any good to us. The first interstellar trip meant something. The ten thousandth is a little boring and unnecessary."

"It can never be unnecessary!" Farley exclaimed. "Did your ancestors talk about things being unnecessary?"

Eric moved restlessly. The other two ignored him.

"No," said Hilda patiently. "Exploration is hardly ever done with any question of *necessity* in mind. It's done because men want to know more, to see more, to do more. And when they know it all, and have seen it all, and have done it all——"

"But they never have!"

Hilda sighed. "True again. But don't you understand, Premier? At first the cost of exploration doesn't matter—provided you can find it from somewhere. You don't expend it as an investment. The people who paid for the first trip to the planets, and the first trip to the stars, never got anything back for it. Not in money. Someone else got money out of it, eventually, but that was another matter.

"Later that didn't apply any more. Money did matter. It wasn't that people became more hard-headed. It was because you don't repeat endlessly something that's been done over and over again unless there's a profit in it. Even galactic exploration has to become a sound profit-and-loss proposition in the end, or it stops.

"And so it has. Sentiment doesn't pay bills. And even if it did, there's not enough sentiment left. Not over worlds like Camisac. Nobody cares whether it's closed down except Camisac, and the other worlds which are going to benefit. Even Camisac doesn't

care much. You'll find three-quarters of your people glad to take what we offer, first time of asking. Three quarters of the rest will follow, given time to think it over and picture the alternative."

Farley didn't hear her words as a reasonable point of view, something with which he might come to agree. He assessed them only as the opposition, the thing he had to overturn somehow.

It was no use pointing out that what Lady Hilda said might be so, but Camisac *was* paying its way. Farley could sacrifice himself and save Camisac, but that was no use to him. It did cross his mind to bargain with them, making use somehow of his knowledge of the true position without actually admitting his own speculation. However, he thought better of it. That wasn't the sort of thing he could do well.

Abruptly, without a word more, he turned and went out. Eric stared after him.

"I thought he'd rant and roar," he murmured, "but I didn't think——"

"That's exactly the trouble," said Hilda sharply. "You didn't think. Eric, didn't I make myself sufficiently clear before Farley came in? Can't you understand this is my responsibility, not yours?"

"I only said . . ." Eric began sulkily.

"Did you, or did you not, interfere with my handling of this affair?"

"Well——"

"This really is the last time, Eric. I think there must be some confusion in your mind over me. At other times I've let you escort me about, danced with you, drunk with you, let you kiss me and generally let you regard me as you would any attractive girl a little too old for you to be likely to marry. Because we've swum and sunbathed and played tennis together, you think it's unfair of me, if not impossible, to try to pull rank and tell you to do as you're told.

"I was off duty then, Eric. I'm not now. Can't you get that into your head?"

He couldn't, Hilda saw. He was pretending to be properly

chastened, and making up his mind not to look for trouble with her again.

But under it all it was precisely as she had said. Eric had seen her laughing, a little tipsy, at diplomatic parties. He had chased her round a swimming pool, ducked her when he caught her, and she had only laughed. He had seen her annoyed at little things, trivial things like a spot of wine on her dress, someone being five minutes late, being unable to get her favourite brand of cigarettes.

He had seen her in the casual, trivial, carefree circumstances of a complicated but well-organised civilisation. He simply couldn't realise that not doing exactly as she told him now was any different from paying no attention, weeks before, when they had both drunk too much and she laughingly told him not to kiss her again.

Eric would have been chagrined to know that she was comparing him and Farley in her mind, not entirely to Farley's disadvantage. They both, Hilda thought,

refused to observe the simple truth, even when it was written in large letters and erected in front of their faces.

Jack Wyger frowned his perplexity. "I don't see what you're getting at," he said.

"That's fine," Farley told him. "You're not meant to."

He looked at Wyger and tried to see into his brain. Wyger was the Deputy Premier. Like many such positions, Wyger's was pretty thankless. People forgot his name. At ceremonies and social functions they stared at him doubtfully, wondering who he was and whether he mattered or not. When deputations went to see Farley and had to be satisfied with Wyger, they felt cheated.

As a matter of fact, as both Wyger and Farley knew perfectly well, Wyger was the real Premier as far as work was concerned. Farley took the limelight, the prestige, the decisions and the responsibility. But a great deal of administration is routine, and a lot of the remainder cold

calculation. Wyger took care of all that.

"If you're planning something," said Wyger, "don't you think I ought to know about it?"

"No. If I do anything at all, you mustn't know anything about it."

Wyger nodded. He was shrewd, and he knew Farley as well as anyone did. He would have liked to know what Farley had in mind, and be able to agree or disagree; but on the other hand, if something wild had to be done—and Wyger, though cautious by nature, knew that sometimes something wild did have to be done—Farley was the man to do it, and Wyger the man to know nothing about it.

And there was another thing. Wyger and Farley, different types with little in common, agreed on one thing—Camisac.

"All right," he said. "There's nothing else I should know, is there?"

"Nothing," said Farley carefully, "that you won't be able to work out for yourself, when the time comes."

Nila came in as Wyger went out. She was curious, and she didn't try to hide it. Curiosity oozed out of her.

"Are you prepared to marry Eric Sturt?" Farley asked.

"Sure," said Nila, without hesitation.

"Why?"

Farley didn't think she would talk of affection or love, and she didn't. "Eric's going to have a lot of chances," she said thoughtfully. "If he handles them right, he could be a big man some day—much bigger than you. Somebody could make something out of him, Big, and it might as well be me."

That was how Farley had thought she would feel. Nila was capable of love—in fact, she had enormous capacity for love. So much that she could love anyone she cared.

Farley dropped a paper on the desk between them. Nila picked it up and surveyed it.

"I see," she said. "When Eric signs that, we'll be married." She looked through it with interest.

With the human race spread comparatively thinly through

the galaxy, laws had to be elastic. Particularly such things as marriage laws. There were a dozen different forms of marriage, all legal. This was the simplest. For the more civilised worlds it should be reinforced by another ceremony later. However, Farley saw Nila already working out that a man of nobility like Eric Sturt wouldn't care to defend a suit based on that document. In effect, if Eric could be persuaded to sign it at any time, he and Nila would be married and would continue to be married.

"How is this going to come about?" Nila demanded.

Farley told her. She considered the matter.

"I'm in," she said finally, "provided you promise to exonerate me if anything goes wrong. It won't do you any harm, and it might do me some good."

Farley accepted the condition without hesitation.

"What shall I pack?" Nila asked.

"Two things only. Clothes and tools."

"Tools? What kind of tools?"

"I don't know. All the most useful things. You're the key person in this, Nila, though it'll take Lady Hilda and Sturt a long time to see it. I know you're not a mechanic or an engineer or an electrician. But you can fiddle with things and make them work, and none of the rest of us can. I checked on that very carefully. Sturt's rating on mechanical aptitude is 79—that means he's a mechanical moron. Lady Hilda's a little better, but she's still only 94. Below average, and with no training to take her any higher."

"How did you get this?" Nila demanded.

"In their private papers, while they were out this morning."

Nila grinned. "If you do land in court," she observed, "there'll be about five hundred charges against you. What's my mechanical aptitude rating? I suppose you found that out, too?"

"You're 128," said Farley. "Not in the genius class, but near enough."

Nila smiled delightedly. "I

wish I'd known about that. I might have made something of it. I remember taking the test, with a lot of others, but nobody told me how I came out."

"Your other talents," Farley remarked, "were probably more obvious."

Nila laughed. But then the seriousness of the matter struck her again, and she asked, soberly: "What do you hope to gain out of this, Farley?"

"Time," said Farley, "mainly time. I'm beaten here, and I know it. If you know you're going to lose a battle, there's only one thing you can do. See if you can postpone the battle. Something may change. At least you get time to think of something else."

Nila pursed her lips. "It's not much of a chance, is it?"

"It's the only one there is. And there's a little more to it than I've told you."

"You can't be an idealist," murmured Nila, puzzled. "You don't even know what an idealist is. Why are you doing it?"

"I've got to."

"Yes, I guess that's it. You just can't swallow defeat. Well, I hope you're lucky. But remember, I'm in this for what I can get out of it. Don't say later I didn't warn you."

"I won't," Farley grunted.

With Eric there was no trouble. Not much caring whether he had to knock him out or not, Farley went quickly and decisively about the business. He pulled Eric's arm from under the sheets and waited. Eric merely grunted in his sleep. A swab of local anæsthetic, an injection, and Eric was out for the next ten hours. Farley left him there while he went to Lady Hilda's room.

Lady Hilda wasn't so easy. There was no trouble about getting in; Farley would have preferred it if there had been. If the doors had been locked it wouldn't have stopped him, but he would have felt better about the episode. The doors being unlocked, even left slightly ajar, made him uncomfortable.

It was like hitting people who refused to guard themselves against attack.

He didn't even have to draw Hilda's arm out. She was sleeping with her arm lying across her, so that he didn't have to move it at all. When he swabbed the skin with anæsthetic, however, she felt the chill of it, sighed, and without waking, slipped her arm under the sheets.

Farley stared at her for a long time. He had nothing against Hilda. He was a man who liked to have a concrete enemy, and he had appointed Centre in his mind to that position. It was Centre he was against, not Lady Hilda.

If he had pictured what it would be like, he would have found some other way. He hated the whole idea of creeping into a girl's bedroom and giving her an injection with a hypodermic. Meeting her in the open, in the daylight, picking her up and carrying her off struggling was another matter. He could have coped with that. He could even have enjoyed it.

However, it was too late

to change his mind now. Gently he drew out Hilda's arm and waited. She lay quite still for a moment. Then, just as he was leaning forward again, she stirred, moved restlessly for a while, and turned over on her other side. It seemed an interminable time before she was still again. Once again she lay with a bare arm over her—the other one this time.

It was some time yet before Farley could complete the business of drugging her, but he managed it in the end, without wakening her. When it was finished and he could relax, he was astonished to find how much relaxing he had to do. He had been tense and sweating since he entered the pavilion. This was not, he admitted to himself, the sort of thing he could do well. He had always despised intrigue of any kind, and stealthiness, and indirectness, and fine manners. A bull, he told himself grimly, was just as much out of place in a lady's chamber as in a chinashop. In a *lady's* chamber, anyway. It was a pity he couldn't bring him-

self to regard Lady Hilda as just a woman.

Nila was waiting outside, a small, vibrant figure in the darkness. She looked like a rocket waiting to be set off.

"Were you holding Lady Hilda's hand?" she asked softly.

It took only half an hour to carry the two Cosmopolitans and their luggage, hastily packed by Nila, to the ship. Farley had thought of using Lady Hilda's ship, which was the right size and much more comfortable than the little scout he eventually decided on. But Hilda and Eric must know far too much about it—in their own ship there was always a possibility that they would be able to turn the tables somehow.

The scout was a five-man vessel which was used for carrying mail, small and particularly valuable cargoes, and occasionally for taking a sick man to hospital. Farley could handle it after a fashion. He knew his limitations; he meant Nila to fly the ship, once he had told her all he knew about it. He was well aware

that after a little instruction she would be a better pilot than he was.

When everything was ready, Nila said quietly, as Farley was checking the fuel and controls: "You could still call it off."

Farley was startled, for he had just been telling himself, as Nila spoke, that it was impossible to call it off now. Once Nila had spoken, he realised that she was right. They could take Hilda and Eric back, and if they were puzzled at sleeping so late next morning, or guessed they had been drugged, Farley could simply laugh at the idea.

He found he didn't really want to call it off, after all. He wasn't given to analysing his motives. Dimly he knew that there was more to the affair than he had told Nila, more than he knew he wasn't telling her.

"You should," Nila said. "This is more than risky. It's mad."

"When I start a thing, I finish it," Farley retorted.

"Oh, well, if you're quite determined on it . . ."

Nila was excited, not because of what was happening, but because *something* was happening. The only way to make Nila unhappy would have been to put her somewhere where nothing ever happened. Even there, she would probably have managed to make something happen.

Farley took the ship up clumsily but quickly. Lady Hilda and Eric were on acceleration couches. He had the strength of an ox and Nila the strength of a young sapling. She wilted under the cruel acceleration, but once it eased she was as spry as ever.

"I want you to learn to fly the ship," Farley told her.

"Me?" She was delighted. Nothing pleased Nila more than a chance to try something new. "But I don't know anything about it."

For once, Farley had a chance to be sarcastic at Nila's expense: "If you did, you wouldn't have to learn."

Piloting a spaceship wasn't easy, but at least in space there was plenty of room. Farley kept her at it for an

hour, and then realised that it was nearly twenty hours since they had slept. Nila was showing no sign of exhaustion, but he sent her to bed.

Left alone in the tiny control room, he occupied himself for a time in working out a course for Undrene, and setting the automatic control by his result. More and more, however, he found it difficult to concentrate. His thoughts weren't disorganised by fatigue, nor by regret, nor by uneasiness about the outcome of the affair.

He couldn't stop thinking about Lady Hilda.

Farley had set the ship's clocks by Camisac time; that would do until they reached their destination. He slept for about five hours, and was checking over the ship at eight o'clock. He looked in on Nila, asleep in the top bunk of one of the cabins, and Lady Hilda, still in a drugged coma in the lower bunk. He had wondered how Lady Hilda would look in her sleep, even before there

was any likelihood of his finding out. He knew she wasn't as young as she looked, and he wondered whether, like some women, she would look her age when asleep, or, like some others, look young and childlike.

The question was settled now. Lady Hilda looked no older than Nila. Her mouth was no longer tight and determined, but soft, tender, full. The faint frown which was generally on her brow was completely smoothed out. The golden hair which was usually rigidly disciplined fell loosely in delightful confusion on the pillow, over her eyes, down on her shoulders.

And now Farley found it quite easy to think of Lady Hilda as a woman—in fact, impossible to think of her otherwise.

Eric, too, looked better asleep. The petulance was gone from his face, and he looked young and fresh and innocent.

Nila appeared as Farley was finishing his enormous breakfast. She was wearing a green blouse which was

stretched tight over her small but very firm breasts, and a long, dramatically fired brown skirt.

"Don't you think it might be a good idea to let him see more of what he's missing?" Farley inquired.

"Mind your own business," retorted Nila, "and I'll look after mine. Have you left anything for the rest of us to eat?"

Vital and tireless, she insisted on continuing the ship-handling lessons immediately after breakfast. Now and then Farley left her and looked in on Lady Hilda and Eric. But he wasn't surprised when they suddenly appeared together, unannounced, in the control room. Eric had a block of wood which looked as if it was meant to be used as a club.

"Before either of you starts anything," said Farley grimly, "listen to this. The radio is out of commission, and I'm the only one of us who can pilot this ship."

"I can——" Eric began rashly, but Farley waved him silent.

"I said I'm the only one who can fly it, and I meant it. She's on automatic, and if you haven't the combination key you can't put her out of automatic. I know a good technician could dismantle the equipment without disabling the ship, but neither of you is a good technician."

"If you think we're going to——" Eric exclaimed.

"Shut up, Eric," Lady Hilda said. "You've made your point, Premier. Will you explain as clearly what this means?"

"With things as they were," said Farley, "you were going to close down Camisac, and there was nothing I could do about it."

"Do you think this makes any difference?"

"I know it does. I'm not a lawyer, but I can read books. In such a case, with you two gone, and the Premier gone, Centre will clamp a status quo order on Camisac for two years. If, at the end of that time, nothing has been heard of any of us, Wyger or somebody else will be Premier and Centre will send another

investigating team to Camisac. But nothing will happen for two years."

"And what difference would two years make, even if all that happened?" asked Lady Hilda patiently.

"I don't know. Nobody does. That's why I'm doing this."

"Of all the crazy schemes!" Eric burst out. "You're mad, Farley. If you were even doing Camisac any good, there might be some point in this. But all that you're doing is setting up criminal charges against yourself——"

"I'm not going to argue about it," said Farley. He found, rather to his surprise, that he was enjoying this. He liked the feeling of power over Lady Hilda and Eric.

"And you!" said Eric, turning to Nila. "You're in this, too. You know what's going to happen to you?"

"I came along unwillingly," said Nila lamely. "I was forced to come. I'm a prisoner, like you."

"That's your story, is it?"

"Yes," said Nila simply.

"What are you going to do

now?" Lady Hilda asked Farley. She had shown no sign whatever of anger or fear or any other emotion. She had been talking as calmly as she had done the last time she spoke with Farley. The drug seemed to have left no ill effects.

"Take you to Undrene," said Farley. He saw Lady Hilda searching her memory for anything she knew about Undrene. "It was abandoned forty years ago," he added.

"And when we get there?"

"We'll stay there."

"All of us?"

"Yes."

"For how long?"

"I don't know."

"You haven't any crazy ideas about holding us for ransom?" Eric inquired.

"No."

"Or trying to force us to go back and report favourably on Camisac?"

"No. But if you agreed to do that, I'd consider it."

"You're doing this," said Lady Hilda, "just for the two years' respite, in the hope that your Deputy Premier will be able to do something?"

"Call it that. If I had any other reasons, I wouldn't necessarily tell you about them."

"Oh!" Lady Hilda exclaimed. For the first time she showed some sign of emotion. She took an involuntary step back and tensed visibly. "I see. You're going to force yourself on me, with or without marriage, in the hope that——"

"No," said Farley. "I realise that might be a good scheme, but I'm not going to do it. That's a promise."

Relieved on that point, Lady Hilda seemed inclined to make the best of the affair. "All right," she said. "Now we know where we stand. You know there'll be a search for us?"

"Naturally. I'm prepared for that. You can't expect me to tell you why I think we won't be found."

"I suppose not. Then we'll call a truce. Of course you know we'll do anything we can to escape."

Farley nodded. "And I'll be doing what I can to make sure you don't."

Nila and Eric seemed a little lost. It seemed incredible to Eric, obviously, that there should be even a pretence of friendliness among them. Nila, too, didn't seem to have anticipated this calm acceptance of the situation.

She returned automatically to something she did understand. She crossed the room, quite unnecessarily, and checked a bank of dials whose purpose she didn't understand.

"If you want to vamp Eric," observed Hilda dispassionately, "you'll have to be much less obvious about it, Nila. He has far more experience than you'd think."

Nila was disconcerted, and couldn't help showing it. Lady Hilda had never made such a thrust at her before. This one was particularly effective, for Nila had put all she knew into the short walk across the open space.

"On Camisac," Hilda went on casually, "I've no doubt all you have to do, Nila, is put on a tight blouse and a skirt you can shake about with your hips, and every male in sight blows off steam at the ears. But life's harder

for a pretty girl in Cosmopolis, Nila. You have to work harder for your effect, and you don't often get it even then."

Nila was fuming, obviously within an ace of throwing herself at Lady Hilda.

"Nila!" said Farley, warningly.

"I don't think I need protection," said Lady Hilda easily.

"I think you do," said Eric, beginning to show real interest in the situation again, "and I should know."

Hilda considered. It was in her power to avert or provoke an actual physical clash with Nila. But sooner or later, Nila being as mercurial as she was, such a clash was inevitable. Hilda didn't believe she could lose such an encounter, and the sooner she established her superiority the better. Nila, she was certain, would respect someone who could beat her at anything.

"If you think you can make me eat my words, Nila," said Hilda, her tone a calculated taunt, "please try."

Nila no longer had to hold herself in check. With a little gasp of pleasure she launched herself at Lady Hilda, checked her attack just as Hilda became completely certain that she had nothing but youthful strength to deal with, and seized the arm which Hilda had placed in the correct position to deal with a vigorous, unscientific attack. The right force applied in the right direction, and Hilda was pulled into the right position to receive a carefully braced knee in the diaphragm.

It wasn't at all ladylike; but then, Hilda should have known not to expect anything ladylike from Nila. Ladylike or not, it was highly effective, and Hilda, in the mere thread of artificial gravity which was all the little ship provided, bounced back hard, bounced again on the steel deck, and finished up most ungracefully under the fixed chart-table, flushed, dazed, and with no breath at all.

Farley couldn't help applauding, the thing was so well done. At once, however, he bent over and helped Hilda to her feet. Nila was flushed

with triumph and gloating. Eric, being only human, said: "Well, I told you so."

But though it was a defeat, and even Lady Hilda couldn't pretend it wasn't, she made the best of it by taking it well and somehow making it clear that Nila couldn't expect to beat her at anything else.

Later, when Nila had gone to check on the food stores and managed to hook Eric to help her, Hilda sighed and murmured to Farley: "She'll get him all right. You planned that, of course?" Farley knew perfectly well he couldn't spar with Lady Hilda. If he tried, he would merely give her a chance to do what she liked with him. He stayed silent.

Hilda sighed again. "This is going to be very dull," she said, "if you two won't even speak. Nila just throws herself at me, and you pretend I haven't said anything."

"That's so," agreed Farley. He knew it was a weak answer, but it was still a very good one to return Lady Hilda. It had no knobs on it which she could catch and use to send it flying back at him.

Lady Hilda made her way to the small storeroom off the main hold where, by arrangement, Eric was waiting. Farley and Nila were in the control room. Eric had chosen the spot because anyone coming to the storeroom had to cross the hold, quite audibly. Hilda doubted that any such precaution was necessary, but made no objection.

Eric was there, waiting impatiently.

"Well, what can we do?" he asked eagerly.

"About what?"

He made a gesture of impatience. "Don't fool around, Hilda. We're not going tamely to Undrene with Farley, are we?"

"So far, I haven't seen what else we can do."

"There's only the two of them. We can handle them any time we like, even if Farley has the only gun on the ship."

"True. I suppose you realise Farley knows that, too?"

"What of it?"

"Generally, when a man makes a sitting duck of himself, he's not quite as unprotected as he seems. And

don't say Farley's a fool, Eric. He's no genius, but he isn't entirely stupid. Assume we jump the other two and tie them up. What do we do next? He's right about the automatic control. It'll take us to Undrene and switch off the drive. Until the control is switched off, we can't even land, let alone go anywhere else, and only Farley can switch it off."

"We can force Farley——"

"Don't waste time even considering that. Farley would let us kill him before doing anything he was determined not to do."

"Then Nila . . ." said Eric quickly.

Hilda looked at him thoughtfully. "You have no objection, then, to—hurting Nila, torturing her if need be?"

Eric reddened. "It needn't come to that."

Hilda shook her head. "That's useless, anyway. Farley won't have told Nila anything he doesn't have to tell her. We can take it, I think, that she couldn't help us even if she wanted to."

"I don't know. There's

something pretty strong between her and Farley. There must be before she'd be along on a trip like this."

He spoke bitterly, and Lady Hilda smiled faintly. Eric hadn't learned yet to conceal his jealousy. "I think she's with us to take care of you," she said.

"What do you mean, 'take care' of me?"

Hilda shrugged. "I left it vague intentionally. She's here to take care of you, but how I'm not prepared to guess. Probably she simply wants you to marry her."

"I told you before that I wouldn't marry a . . ." He groped for words.

"A what?" asked Lady Hilda curiously. "A girl from Camisac?"

"Yes, if you like to put it that way. I'm not a snob, not in the birth sense. But though the girl I marry may not be from a noble family, she'll have to be clean, intelligent, gracious, decent, good-humoured and pretty."

Hilda raised her eyebrows. "You're more sensible and modest than I thought, Eric," she admitted. "Far be it

from me to press Nila's suit—but which of those things do you think she's not?"

"Forget it. Let's come back to the point. Do you really think Nila can't help us?"

Hilda considered. "Not now. Later, perhaps—once she's had time to get tired of the whole thing, fed up of just the three of us, annoyed at Farley and ready to do anything for a change."

"Then are we going to Undrene?"

"Yes. We can reconsider the matter there. I'm very curious about what Farley means to do with us, Eric. He can't very well lock us up permanently. We'll be able to escape whenever we like. And though I suppose he'll have put this ship out of action and there aren't any others left on Undrene, what's to stop us keeping out of Farley's way and yet making contact with the ship which will certainly come to Undrene, among other places, looking for us? I don't see that part at all."

As she stopped speaking, they heard the sound of footsteps in the hold. They

waited, and presently Nila came in.

"Hello," she said in a friendly tone. "Plotting as usual, I suppose. While you're at it, would you like to know where I stand in this?"

Hilda made a sign to Eric which, for once, he decided to obey. Having opened his mouth, he shut it again.

"Very much," said Hilda.

"When I told you I came along unwillingly," Nila told them, "it was near enough true. Farley asked me, and I said yes. But as you can imagine, he wasn't going to let anything I said or did make any difference. I could come along, or be left locked in my room or something like that."

Hilda nodded. "I expect that's so," she said encouragingly. "I suppose you haven't any clearer idea than we have exactly what he hopes to gain?"

"I think it's as he says. How do *you* figure it?"

"Farley's obstinate," said Hilda. "He gets what he wants by hanging on longer than anyone else. When the other fellow thinks he's won,

and relaxes, Farley's still got a kick in him. He's never been beaten because he can't be beaten. He doesn't know how to surrender. If a thing is so, and he can't change it, he's got to turn what looks like defeat into victory somehow. This was the only thing he could think of to do this time, so he did it."

Nila nodded admiringly. "Right all the way," she said.

"There's something we'd like to know about you, Nila. What are your relations with Farley?"

"I haven't any."

Hilda sighed. "If you don't answer—more than that—if you don't convince us of the truth of what you say, you can't expect any sort of trust, can you?"

Nila considered. "I might be his daughter. My mother was . . . well . . ."

"Like you," said Eric, with involuntary bitterness.

Nila looked at him coolly. "If I'm a slut," she said, "you should know, shouldn't you?"

Eric reddened.

"Probably," Nila admitted, "Farley has some excuse for

thinking I might be his daughter. But I don't think it's so, though it's been a good thing to have him look after me."

"And you're prepared to abandon him?" Lady Hilda asked.

"I told him that when I agreed to come along," retorted Nila.

Hilda nodded slowly. "So he knows not to trust you too far," she murmured.

"He will, all the same."

"And you'll still betray him, if it suits you?"

"It's not worth talking to you," said Nila impatiently. "You don't seem to understand ordinary common sense. I'm going."

She flounced away with the usual swirl of skirt. Hilda grasped Eric's arm tightly and didn't release it until Nila's footsteps had died away.

"Why did you let her go like that?" Eric asked.

"Because she didn't want to go like that," Hilda said tranquilly. "We were supposed to call her back. Now, where were we?"

(To be concluded in the next issue.)

The Shell Game

by E. C. TUBB

I WISH THAT PEOPLE WOULD stop talking and writing and singing about space travel as if it were something wonderful. To listen to them you'd think that anyone who got themselves a soft number operating a spaceship automatically deserved a pension and the Solar Star. In reality, of course, there's nothing to shout about. I don't know what the early days were like, pretty grim I expect, but now a trip to the planets is one of the most boring things I can imagine.

I was thinking about it on the way to Mars. I rested in my coffin-like cabin and kept telling myself that, while free-fall might be nauseating, it wasn't fatal. At least no one yet had died from it but, as I groaned and twisted on the bunk, I wasn't so sure that I wouldn't set a precedent.

I was still thinking of the

relative warmth and comfort of the Luna Penal Colony when someone tapped on my door.

"Mr. Dribble?" The cook, an offensive-looking creature with a scarred face and a squinting eye, peered towards me. Probably he hoped that I was dead, or unconscious or something, because he seemed disappointed when I sat up.

"What is it?"

"I thought you'd like a sip of stew." He handed me a tube-container and made expressions of sympathy. "It'll settle your stomach."

"Nothing can do that," I said. I sipped at the tube and then took another sip. "Stew?"

"That's right."

I didn't argue, but took another sip. If the cook was in the habit of calling hundred-proof spirit "stew" then I

wasn't going to complain. The rot-gut warmed me and, for the first time since leaving Luna, I began to feel like a human being.

The cook waited while I sipped the rest of his mixture and, for some reason, I got the impression that he was waiting for something. Knowing the human race as I do I guessed that it could be only one thing.

I was right.

He tucked away the ten credit note and immediately became more friendly.

"This your first trip, soldier?"

"Dusty," I corrected. "Dusty Dribble, the finest salesman yet."

"That right?" He didn't seem impressed. Maybe he remembered the way I had come aboard. "What you aim to sell on Mars?"

"I'll find something." I swallowed as the nausea returned and grabbed at my stomach. "Why don't they put spin on this tub like they do on the passenger ships?"

"Takes fuel," he said shortly. "The cargo don't

complain and we're used to it." He showed me his teeth in what he probably imagined was a smile. "You'll get used to it, too, in time."

He was right, too. After the second week I managed to get the hang of the magnetic boots and had lost the feeling that I'd prefer to be dead. With normal health came normal curiosity and I took a look at what was to be my home for the next few weeks. I didn't think much of it.

The ship was an old, beat-up can with a hull like a sieve and engines which seemed almost ready to fall apart. The crew matched the vessel in being some of the most ungentlemanly characters I'd ever met. Aside from the cook there was an engineer, an astrologer, and the captain. I'd met the captain before when he'd relieved me of most of my portable cash for the passage money, and I already knew him to be a money-hungry pirate totally devoid of any form of ethics.

As there is nothing to do while in space, except make sure that you're going in the right direction, the crew had

plenty of time in which to amuse themselves. They made a habit of congregating in the one compartment which served as everything from mess hall to recreation room. I, as the sole passenger, was the only one privileged to a cabin of my own; the others all bunked in together.

As I said, a nice friendly ship to be stuck on.

Naturally, we played cards.

Poker, the game was, and it was one of the most cut-throat games I've ever sat in on. Luckily I still had some money left or I would have died from boredom, but as I watched my pile melt away into the capacious pockets of the captain, I began to get an uneasy suspicion that all was not as honest as it could be.

I was certain of it about halfway to Mars.

As usual, the game was jackpot, deuces wild, and I was interested in more ways than one. First, I wanted to know how the captain always managed to deal me a good hand and himself a better one, and then I was interested

in learning how to win my money back. I concentrated on the play and tried to remember what old Gerard had once taught me.

Gerard was a one-time demonstrator who had operated with the Magic-Deck. He had sold a pack of cards and could tell anyone the exact hand they drew, the cards they dealt, and what would come next. For him it was easy. He wore a special set of spectacles and had painted the backs of the cards with radiant paint. Normally it was invisible, but when viewed through the special glass it was just as if he dealt the cards face up.

Add a little manipulation to the above and you'll realise why he was chased out of more Exhibitions than he could get into. His one weakness was in not knowing when he'd made enough and the tough industrial workers didn't like the idea of him taking all their hard-earned wages.

Anyway, I remembered Gerard and very soon I knew how I was always a consistent loser. The captain, Kinard,

his name was, wore contact lenses. The cards, when I peered at them against the light, showed traces of something smeared on the backs. I was the mythical pigeon, and brother, was I being plucked!

It was time for me to do some real thinking.

I thought of the shell game.

You know it? Three shells with one pea and the trick is to find out which shell the pea is beneath. Of course it isn't beneath any of them; the operator palms it so the sucker can't win, but that is the game in its most crude form. I'd improved it. I had to ever since the players got the bright idea of resting their finger on one shell and making me lift the other two. I'd hit bottom before I'd thought of a way out and now I'd fixed it so that I couldn't lose.

That, incidentally, is the only way to play that or any other so-called game of chance.

Still, even with my unbeatable set-up. I didn't like to use it. I have a professional pride in what I do and I

draw the line at sheer robbery. Value for money is the way I like to operate. Of course, what value for how much money is something else again, but you can see the difference, can't you?

Exactly.

Still, we had days of boredom to get through, I was headed for a planet where everything would be new to me, and I didn't like the thought of landing without a credit to my name. So I dug out the equipment and checked it ready for operation.

Basically, it was simple.

I had three plastic cups with built-in permanent magnets. The pea itself was another magnet of opposite polarity. So, normally, it would cling to the top of the shell. However, just in case, I'd fixed up a gimmick to prevent any arguments. I used three peas, one for each shell. I had a battery beneath my coat, the wires taped to my lower arms and my hands dusted with flesh-coloured conductive powder. I rigged two switches in my shoe so that I could activate the

current with either big toe. Get it?

That's right. Current on and the magnet would be opposed and the pea would fall. Current off and the pea would cling to the upper part of the shell. I could select any pea, right or left hand, and so I couldn't lose.

I hoped.

I introduced the game just as they were setting up the usual poker table.

"Here's something new," I said, and put out my little shells. "See?" I pressed down with my right toe, gripped the shell, and the pea dropped onto the table. "Here is a pea. Now all we do is to move it from one shell to the other and then you bet that you can tell where it is." While I was talking I was manipulating the shells. Naturally, I had to be careful that I didn't get two peas sticking in the same cup, but that, to me, was simple.

I just kept talking.

It's surprising how easy it is to numb someone's concentration. When you're talking they are, consciously or

not, listening to you. Also, the rapid movement of the hands tends to tire the eye. Add persistence of vision, double-talk, cover the necessary with unnecessary movements, and they don't stand a chance.

I stopped the rapid movement of the shells and waved an invitation.

"Come on, lads. Take your pick. The more you put down the more you pick up. All bets covered. Just find the pea and rake in the cash; the simplest and most honest game ever invented. You simply back the sharpness of your eyes against the skill of my hands. You, sir!" I pointed towards Kinard. "Pick a shell. Just for fun, this time, no bets. Go on, pick one."

He did and, naturally, he won. Or he would have had there been money down. I manipulated the shells again.

If things had been different maybe they wouldn't have been so eager to play. But space is boring, they were sick of the eternal poker, and ready for something new. Kinard pulled money, my

money, from his pocket and slapped down a ten credit note. He waited until my hands had ceased moving and then pulled the one with whiskers on. He rested his finger on one shell.

"This one."

"That one?" I went to lift it up and he grinned at me.

"Uh, uh. Let's see if it's under the others."

I sighed. Obviously he imagined that there was no pea at all. Equally obviously he didn't dream that I had also thought of that. I tripped the switch in my right shoe, lifted the right shell, and showed him the pea. I lifted the left shell—no pea. He lifted his own with the same result. I collected the ten credits.

"Better luck next time, captain," I said cheerfully. "Now, who's next?"

The cook had a go, then the astrogator, then the engineer. Then two of them had a go at once, then three, then just one again. They tried everything they could think of in as many combina-

tions as they could—and I won almost every time.

Almost. It's bad psychology not to let a sucker win sometimes and I let them win just enough for them to get the taste. Even at that they were only winning from each other. I wasn't that generous. By the end of the session I had recovered most of my money and only managed to shut down on the promise that I would play some more later on.

They really liked the shell game.

The radar was blipping when I entered the room for the next session. Kinard looked worried as though something had gone wrong, and he and the astrogator muttered together as they entered the control room. The cook grinned at me and I grinned back. Then I set up the shells and we began to play some more.

The blipping of the radar disturbed me a little. I kept thinking of Patrol Ships, and I let the cook win a couple of times when it wasn't necessary for him to win at all.

"What's that noise all about?"

"Nothing." Kinard came into the room just as I asked the question. "Routine check. Think nothing of it." He tugged money from his pockets and slapped down the biggest wad of notes yet. "Let's play some more."

We did. We played until my toes began to get sore from tripping the switches and I lost count of all I'd won. Finally, after a period in which my arms ached from manipulating the shells and raking in the money, Kinard grunted and slapped his pockets.

"You've cleaned me out," he grumbled. "I haven't got a credit left."

"Too bad." I picked up the shells and stuffed them into my pocket. No sense in continuing the play if there was nothing to be won. He halted me as I was leaving the room.

"Hold on a minute. I've been thinking about that game you showed us and I've got an idea that I can beat it."

"You have?" I smiled,

not grinned, and let myself be persuaded back into the room. Kinard, despite his toughness, was as dumb as the next man. He thought he could beat the shell game. The sucker!

"Look," he said. "I own this ship. Now I'll tell you what I'll do. I'll back a part of it against the money you won. Right?"

I thought about it. Space-ships, even wrecks like this one, were valuable. I could sell it when I got to Mars and have a fat bank account for a change. I'd be rich! I nodded and we began to play.

Kinard had his ship and cargo and I had the loose money. He set up part of the cargo against the money and I won it. I won the rest of the cargo, the engines, the control room instruments, the hull, the accessories, the equipment. I won everything but the clothes from his back and one-fifth of the fuel. That was important. I couldn't land without the fuel.

"I've never seen such luck," said Kinard. He looked anxious. "Look, I'm in a spot.

I've got to have some cash to pay off the crew. That's only fair, isn't it?"

I nodded.

"Well, then. I'll back the final works against that money you've got. If you win you give me the cash and take the ship and cargo. If I win I'll sell you my share of the ship for the cash, pay off the crew and settle with you after the sale of cargo. Right?"

"Right." Either way I couldn't lose and, more important, I didn't want to have a mutiny aboard my spaceship. In any case Kinard couldn't win.

He didn't.

"Well, Dusty, that makes you the full owner of ship and cargo," he said. He held out his hand for the money and I paid him. I hated to see it go, but what I'd won in return would compensate me a hundred times for its loss. "I'll alter the papers and she's all yours." He shook his head as I picked up the shells. "Man, but you're lucky!"

"Skill," I said loftily. "That and the breaks. You can't fight against the breaks."

"That's right," he admitted, and grinned. It worried me that grin. It didn't seem natural.

I found out why after we'd landed.

The port authorities at Marsville came aboard as soon as we'd opened up and the inspector, a hard-faced character, glared at us as we stood in the control room.

"Who's the owner of this ship?"

"I am," I said quickly. I didn't want to give the others a chance to deny it. "That's right, isn't it?"

"That's right," said Kinard. "You're the full owner." He nodded to the inspector and stepped to the head of the ramp. The cook and the rest of the crew followed him. I stepped after him and was promptly stopped.

"Not so fast, Dribble." The inspector had got my name from the ship's papers. "As the owner you're responsible for this tub and you can't leave until it's cleared." He gestured to the men he had brought with him. "Right, you

guys. Search her, and search her good."

While they were searching I got the first impression that all was not as it should be. Kinard had gone with all the available cash aboard and, as time passed, I began to wonder who had been smartest between us.

I knew for sure when the search had been completed. "Contraband," said the inspector curtly. "So the tip-off was genuine. How do you account for this, Dribble?"

I stammered at him.

"We suspected something like this and so contacted you while in space and diverted you to Marsville." He seemed to have a personal dislike for me because he just wouldn't let me explain. "If we hadn't you'd have probably landed somewhere in the desert, unloaded, and then touched down at an isolated field for refuelling." He glared at me. "You're in trouble, Dribble, real trouble."

That was an understatement.

When I tried to tell them that Kinard had deliberately let me win the ship and cargo because he knew he was certain to be caught smuggling, they laughed. They pointed out that no one could be so lucky as all that and, as the penalties are rather nasty for any operator of a rigged game, I couldn't tell them the whole truth.

So if you want to know what the penalties are for running contraband I can tell you.

First, they confiscate your ship.

Then they fine you three times the value of the contraband you tried to smuggle and, if you haven't got the money to pay, they give you ten days to find it or you go to jail.

But even at that I suppose I'm lucky. If the Patrol Ship hadn't escorted us in Kinard would have probably taken back his ship and dumped me out somewhere in the middle of a desert.

Now all I've got to do is to stay out of jail.

There had never been such a—

Rondo in Time

BY MARTIN JORDAN

"**T**IME TRAVEL'S UN-natural," said Miss Balsam.

She was a skinny chip of Kensington, London, and she had been devoted to the composer, Hubingrath, for thirty years as secretary, protector and friend. The relationship had never deteriorated from the platonic, which on the surface seemed strange, for Hubingrath was a great lover. But the fact was, Hubingrath liked plump women. For years Miss Balsam had pensively experimented with pastries and Devonshire cream; now, in angular middle-age, she had reached a stage of brisk acceptance...

"If it's unnatural," Hubingrath said, "so's Time itself."

"T-T's just a craze. Real people get on with the job in their own age."

"I've a feeling I'll never write another symphony. I felt the urge dying on me

years back, like the head on a pint of beer. I want to get to know a world that likes my music. Visit the future."

"Geniuses don't care a pip what people think—now or in the future."

"I care a whole lot. So probably did every composer since Palestrina."

He gazed out of the window, surveying his world of Gore Mews. There was not much of it to be seen; Hubingrath occupied one of the last Mews flats to be found in London, and his view was bounded by a decaying row of garages which, since the banning of private transport from the central area, were filled with the neglected works of sculptors, painters and dreamers in metal.

"All right—go to your future. What if no one there has ever heard of you?"

He turned back into the

untidy room. Miss Balsam was sitting at his antique electric typewriter; she came to Gore Mews every day to answer the letters that still reached him from odd corners of the earth, for although the concert-going public was sour about his music, promoters from Fez to Yucatan persisted in playing it.

"In that case," he scowled, combing his greying hair with long fingers, "I'll try to sell 'em some of my music."

The T-T technician was sympathetic and discouraging. "Doctor Hubingrath? Do sit down. Yes, we've checked your application. We always advise people *against* T-T if they're engaged in the arts. Think of the psychologic dangers. For all I know you might consider yourself a genius. Right. You land, say, in 2150 A.D., and nobody there has heard of you—your works are pulp. So you come back to your own time and spend the rest of your life looking into a glass in some drinkery . . . wasted."

Hubingrath said: "I'm not modest—I *am* a genius. Up

there in the future my name has a big sound like Beethoven."

"I guess there are people who know if that's true—I mean, returned time travellers. Of course, it's an offence to reveal the judgments of the future to a third party, especially if that party happens to be the subject."

"I demand T-T," Hubingrath said.

"Well, it's a free world . . . But take my advice and stay. Your works aren't exactly popular, except among a few advanced composers; you've often been called a composers' composer. They're felt to be too contrapuntal, too austere. It's probable that the future won't be feeling differently—and then you'll have taken on a load of avoidable grief. Whereas, if you leave T-T alone and keep on composing you might produce something that'll . . ."

"I know—rumtitum for film strips. Well, I've written all the music I'm going to write. Where's that time-cubicle?"

"On your own head be it," sighed the technician. "By the way, the travelling part is

instantaneous. An identification-formula has to be tattooed on your arm. You have to go it naked in case your clothes would cause a blow-out. There's also the matter of your grave. You've heard of radio-plastic? It's a bit of solid radiation like paper, with a life of under sixty seconds. It takes perforation-messages, and those are our only means of teleprinting the future to tell them to trace your remains and reduce them to radiation . . ."

When Hubingrath, after various checks, re-checks and delays, was confined in a T-T cubicle and sent with a flash and a smell of ozone into the year 2150, he noticed that the journey took less than a blink. A man entered the cubicle and clothed him in opulent stuff like silk, uncreasable as rubber. A blonde followed with smiles and flowers. The man said: "I am Brud, time guide. This is my colleague, Dris Leberth. Welcome, doctor. We have a full schedule—a concert in your honour at the Cybernetic Hall, the free-

dom of the City, various honorary degrees . . ."

"Am I famous?" Hubingrath asked, with an effort.

"Are you *famous*? You're Hubingrath!"

The Cybernetic Hall was packed. Beefy and dignified, the leaders of the ruling class pumped his hand and confessed with too much insistence that music was the one thing they cared about. The wives of the leaders tried to show him their souls through their eyes. Dris Leberth squeezed his arm sympathetically and whispered an insulting commentary on her own sex; Hubingrath began to like the shape and sound of her.

On her side, she had fallen for him before the static had faded in his T-T cubicle. In spite of his advanced age he was an example of emphatic masculinity—large, powered with muscle—a figure to grace the prow of a Viking ship. When he stood on the platform in the Hall, a keen observer would have noted that the female part of the audience was motionless, entranced and slightly pop-eyed.

Hubingrath made what he took to be a halting and modest speech, but one which appealed to the females as the roaring of an especially pagan bull. He returned to his seat amid applause and the concert began.

It was a concert of his music. He had a dim idea that his Fifth Symphony was being played. There was no orchestra; the music seemed to come from all sides at once . . . The *noise*, rather—for Hubingrath quickly lost all sense of music. The tempo was there, and he could recognise the dramatic emphasis of his first movement, but the sound was like the mouthshootings of cats—a chorus of bronchials—the brakes of a thousand 'buses, all performing in a farmyard. When, three quarters of an hour later, the coda crashed down on his eardrums, he felt physically bruised.

More speeches followed. Hubingrath mumbled something in reply. He was escorted outside, where a fleet of mothlike aircars stood in what he recognised as Kensington Gardens. "Next stop,

Westminster Abbey," Brud said. "Your grave, you know . . ."

In the aircar he sought an explanation of the cacophony they had endured.

"That was the Cybernola," Brud told him. "I don't know much about it. I've a pal at Music Feed—Danl Ebow—who could give you details. It's reckoned to be a great improvement on the human orchestra."

"A sort of record-player?"

"No, it sight-reads from a score. You might call it a complete robot orchestra."

"But where was it? I didn't see any machine."

"You were inside it. The whole Cybernetic Hall is the machine. The part where the audience sits is the resonance-chamber."

They landed in Parliament Square, where Westminster Abbey was intact amongst monster ministries of glass and plastic. Inside there was a small, solemn ceremony around a flower-covered stone inscribed:

ALBERT HUBINGRATH

Composer. Born 1951.

Revisited this spot in 2150.

"Died—when?" Hubingrath queried, his heart pumping.

"That is a morbid enquiry," Brud said. "Of course, it's possible for you to find out, but that would be reckoned bad taste. Death, in the old-world sense, has been conquered. The date of your death is of no more significance than the date when you cut your first tooth."

"What is there exactly under this stone?"

"Nothing. As soon as the Time Port in your epoch signalled that you were travelling, your remains had to be reduced to radiation. Otherwise Westminster Abbey would have blown itself out of the solar system. The risk of T-T is that material molecules—in this case, your skeleton—may be forced to exist twice in the same epoch. If that happens there's a blow-out."

Hubingrath glanced at the bunch of exotic orchids they had given him at the concert. Strange effeminate custom! He said: "What would happen if I took these back with me as a keepsake?"

"Oh, *quite* a blow-out," the girl broke in. "The flowers would get through intact, but various molecules all over the world which were destined to *be* those flowers would *fizz*. It works both ways; you had to travel naked—remember? In spite of precautions, there've been lots of casualties since T-T was invented."

Hubingrath was shoved forward to receive the congratulations of the School of Musical Electronics.

He whispered to Brud: "What's Musical Electronics?"

"The study of the thing that played your symphony—the Cybernola."

"Didn't you say you knew a man . . ."

"You mean, Danl Ebow?"

"Is he in any way responsible for the noise that comes out of that machine?"

"Well, I think he decides on the actual *notes*. Want to meet him?"

"I want to kill him," Hubingrath said grimly.

Danl Ebow, musicologist, was busy in his office at Music Feed. He was ginger-

haired and in the old age of youth. He had just punched up from the library a priceless manuscript—the Tenth Symphony of the great composer, Hubingrath. The manuscript was over a hundred years old.

Danl's job of transcribing for the Cybernola called for no special talent; he had only to construct a more overwhelming balance of sound to suit tough twenty-second century ears; the robot computer, which was built into the instrument, would do the rest.

The door buzzed. Danl said: "What?" The door said: "Filp Brud, time guide."

"Yes," Danl said.

A moment later the door admitted Brud.

"Hi, Danl."

"What's the trouble, Brud?"

"Still a symphonic cyber-transcriber?"

"Why, yes."

"How many of the old symphonies do you reckon you've dealt with?"

"Hundreds. All the major works of three centuries, beginning with Mozart."

"And ending with Hubingrath?"

"I've done the first nine of Hubingrath's, and now I'm starting on the Tenth and last."

"In the year 2010 T-T was invented."

"Yes, about then, I suppose."

"You'll have to reckon from now on with the composers themselves. In person."

Danl was silent. It had not occurred to him before, but Brud was right, of course.

"Well, I'm an artist," he said, at length. "And the Cybernola's an instrument of integrity. So what?"

"I just thought a word of warning . . . I've got Hubingrath downstairs—brought his sore head all the way from 2011 A.D."

"*Hubingrath?*"

"Composer—born 1951, died 2021. If you manage to cool him down you might get to basking in his surplus. Concentrated male type. Dris has fallen for him without a whistle. Anyway, he insists on seeing you."

Danl detected an unpleasing rhythm in his stomach, as if ghostly bulldozers were redistributing his lunch. He had

never been closer to a famous T-T visitor than the twentieth circle of a lecture bowl. Hubingrath! It was like meeting Bach or Beethoven. He began to be over-aware of his ginger hair and rather bad ear for enharmonics.

"If he insists . . . Of course, it's a great honour . . ."

"I'll bring him up. There's always the corridor robot if he turns ugly."

With which heartening speech, Brud withdrew, leaving Danl to gaze pensively at the crowded notes of the Tenth Symphony.

It was not long before Brud returned. Dris Leberth was with him, and also a huge, grey-haired figure—a figure which Danl had often seen in old photographs, but which now hit his senses with the special impact of revered and famous flesh.

"Are you the man?" Hubingrath boomed.

Danl, tongue-tied, had risen. Hubingrath reduced the room's size to a rat-trap.

"Well?"

"I . . . I am Danl Ebow. Indeed . . . an honour, Doctor Hubingrath . . ."

"Cut out the compliments. What does this age mean by mutilating my music?"

"M-mutilating?"

"I take a trip to this *dreigroschen* epoch, and a monstrous machine plays my Fifth Symphony in my honour. *In my honour!* Not an orchestra—not *people*, with hands and hearts—not even a *recording* of an orchestra—just a box of mechanical tricks as big as a parish church, and my music sounds like the submerging of a submarine! I'll go to law! I'll get an injunction!"

"I've explained to Doctor Hubingrath," Brud said, "that litigation can't be applied as between epochs. Apart from which, the copyrights have expired."

"Is that so? Then I'll buy up every publisher's stock in my own age and burn the lot!"

"The fact is," Dris put in, "you aren't going to—because we've *got* your symphonies, haven't we?"

"The Cybernola," Danl stammered, "makes music infinitely more rich . . . As a musician you know that the

equal-temperament instruments of your time couldn't attain *all* the notes. The Cybernola deals in micro-tones—plays the upper partials. It's a composer's dream. Take the *adagietto* of your Tenth Symphony, for instance——"

"My *Tenth*?"

"The string fugue in the second movement shows just what I mean."

"But . . ." Hubingrath was suddenly agitated. "*I haven't written a Tenth Symphony!*"

There was a silence. Both the Time Squad officers shrugged.

"You will," Brud said.

"Listen, you're not *me*. I'm me, and I know what's inside me. I shan't ever write a Tenth Symphony."

"The arguments to prove that you shall," Dris sighed, "cover about fifty spools of math. in any public library."

"I happen to have your original manuscript here," Danl said, holding up the pile of music paper. "It's right here, and you've written it."

Hubingrath reached out a big hand. "Let's have a look."

Brud restrained him.

"It's against the code."

"Can't I look at my own symphony?"

"It's known to be disastrous for any sort of artist to peep at his uncreated works. It'll be a terribly bad symphony if you look at it now. There was the case of Tetrotti's painting *The Cog*. It's considered to be his worst—scarcely worthy of Tetrotti—and critics point to the fact that he slipped his T-T guide last year and visited the Tate Gallery and inspected it before he'd painted it."

But Hubingrath was staring at Danl's fistful of manuscript with such intensity that sweat had started on his forehead. He growled: "A painter never sees his pictures, a poet never reads his poems, a composer never hears his own works! People talk of self-criticism—I've rejected acres of music on that basis—but it's all cold technique. When I hear one of my nine symphonies it's with such an awareness of the cost—of the agony with which the stuff drifted out of me—that I don't hear it as *music* at all. Know what it'd mean to me to sight-read my Tenth? I'd be

hearing my own work for the first time—as something *new*, as it was meant to be heard!”

Dris asked Danl: “What do people think of the Tenth Symphony?”

“It’s a classic. On a smaller scale than the other nine—more melodic. A ‘little’ symphony. But fresh and exquisite. A re-discovery of youth and love.”

Dris smiled at Hubingrath with a look that invoked both qualities.

“I don’t think you’re going to inspect that manuscript after all.”

Hubingrath looked her up and down, and then his eyes returned to her face with its crown of hair as blonde as primroses.

“Youth and love? And you offered me a *machine* for my inspiration?”

“Maybe you’d like me to show you round Music Feed?” Dris smoothly asked.

“The gardens especially,” Hubingrath said.

She took his arm.

When the pair had gone, Danl sat at his desk. He had been aware of Dris as a

powerful incentive to mind-wandering; even the unusual nature of the interview had not stopped his eyes from shifting with the sombre glance of a man monotonously unsuccessful with women.

“She’s quite a bundle.”

“That’s telling,” Brud said. “From now on I think we can count Hubingrath as under control. They’ll end up in Dris’s apartment.”

Danl winced. In matters of ethics he was a throwback to what he faithfully regarded as a healthier age.

“It’s fashionable for girls to want time babies,” Brud went on. “Every genius from way back who visits this epoch gets invited into bed sooner or later. Of course, biologically speaking, the theory that genius begets genius is a bygone . . . but women are too busy being practical to bother about theories.”

“This symphony . . . I suppose there’s no doubt that he’ll write it?”

“It’s a physical impossibility for him not to. What do the books say? When was it written?”

"It was found among his papers after his death. He didn't publish it or have it played publicly during his lifetime."

Dris had retired, and when she came back to the living room it was in something that clung and shimmered. Two smooth arms went round Hubingrath's neck, and her voice, fat and purry, tickled his ear. "Know something? You're a honeypot."

Hubingrath permitted his own enjoyment with the lazy pleasure of a big dog in sunshine; one was forced, he told himself amusedly, to fill the future with the older pastimes.

He began to kiss her systematically.

Later, she said: "Am I inspiring your Tenth Symphony?"

"Yes, I hear the music of the spheres."

"There it is, that symphony," she said, "—over in Danl's office—the manuscript in your own writing . . . and in every tape shop it's on spools for anyone to buy . . . and people have been humming bits of it on the sidewalk for a hundred

years . . . and here I am inspiring it! That's T-T!"

"It's heaven."

Later still, he raised his head and saw so many photographs on the walls that the room seemed peopled by rows of peeping Toms. The photographs were coloured, stereoscopic and lifelike. They were exclusively male and the subjects were of all ages, and the pale and dark and smooth and bearded faces seemed to leer with a tedious uniformity.

"You've got some family portraits."

Dris laughed sleepily. "Don't you recognise them? But of course not—they weren't even born in your time! There's Kroomaswami Jenkin, the poet; Mel Roche, Nobel physics winner; the architect of the Cybernetic Hall, Gail Bertin; Nevl Preen, who flew in the first escape-orbit—"

"Wait!" Hubingrath ordered. "They've *all* been here?"

"Why, of course!" She raised herself up-elbow. "You're not going all funny and twentieth century?"

"Each one's been a time

traveller and seen the inside of this apartment!"

"You're trembling. Is it rage?"

"It's claustrophobia," he said. He was dressing.

"But the symphony . . . I was inspiring it, wasn't I?"

"Lady," he said, "you started something, but it turned out to be a repetition."

When he reached the door she wailed: "Stop! You're not allowed out without a time guide!" But Hubingrath did not look back.

He emerged at street level into a part of London that had changed totally. Nevertheless a stubborn Londoner's sense told him that he was in Paddington. He began to plod in the direction of Langham Place and Music Feed.

He reached the building without difficulty. Danl's office was empty—the fact was announced by the door as he made to open it. He went ahead. There was nobody in the room.

Well, he had seen enough. He would make his way to the Time Port and get back to . . .

To what? A.D. 2011 and the Tenth Symphony.

The symphony he wasn't going to write.

He knew himself to be incapable of writing it.

He saw the desk, as left by Danl, with the manuscript of the Tenth Symphony solid and fat—played and blessed by generations, and what was more—written.

Danl and Brud were in the bar when a screen buzzed and a ruffled Dris appeared. She spoke rapidly and a smear of displaced lipstick danced. "Brud, I've been sitting here screwing courage to buzz you. Hubingrath went off on his own—and I wasn't . . . able to follow."

"Any idea where he was going?"

"No. Maybe back to Danl's office."

"You've done a thorough jinx," he told her brutally, and switched off.

"Let's go to your office—he may be there."

In the lift he swore quietly. "It's against the law for time travellers to be on their own. They go mad—rush around

trying to make their descendants' fortunes in real estate..."

They reached Danl's room with its bare desk-top.

"That symphony's gone," Danl said.

Brud tensely figured.

"Would any of the staff have taken it? Secretary?"

"I haven't one. Maybe Hubingrath's off back on his own."

Brud said: "*Blow-out!*"

"What?"

"Blow-out, and more—more! I don't know *what* more. T-T's still in its infancy."

"How do you mean?"

"Look—he takes the manuscript back with him. There's a blow-out, because the molecules that make up the paper already exist in his epoch. It would be those scattered molecules that'd blow—not the manuscript. The molecules would be existing all over in things like cotton seeds, rags. Casualties among people who happened to be near them. The manuscript would be left—and there my brain boggles. It would be something in Hubingrath's writing that he hadn't written—a

child of his brain that he hadn't begotten."

"But it'd be a thing from the *future*! If it stayed in his epoch it'd remain there until it caught up with the future... and then... then..."

"In that case, tell me this——" Brud scowled. "Where did it come from *in the first place?*"

Hubingrath moved through the indifferent crowds quickly, obsessed with a notion that something obscurely technical might happen to maroon him and make inaccessible that London where no robot orchestra ever played—a London, he decided suddenly, that he loved. He clutched the Tenth Symphony like a child's school prize; childlike, he resolved not to look at it except in the shelter of his own Mews flat...

The Time Port was a semi-circular foyer bordered by cubicles of paper-thin metal, over which loomed an apparatus room as big as an old-world power station.

No one was in sight. He crossed the glossy floor, making straight for the cubicle of

his arrival. The door said, compactly: "Epsilon Three Thousand—unaccompanied by T-T guide."

"I—er—lost him."

"Epsilon Three Thousand wishes to travel?"

"He does."

"Epsilon Three Thousand must undress."

Hubingrath struggled out of his clothes and left them like an offering in front of the door. Clutching his symphony he reached for the push-button opener.

"Epsilon Three Thousand must put down the material that Epsilon Three Thousand is carrying."

Hubingrath said an antique word. At the same time he heard a shout, and, turning, saw two running figures—Danl and Brud. He pushed the button and the door opened and he went in, the symphony gathered to his hairy chest.

There was nothing inside but another button. He pressed it, cutting off the machine as it was protesting: "But Epsilon Three Thousand . . ."

"Ah," said the T-T technician. "Doctor Hubingrath. We ask no questions. I'll buzz for your clothes . . ." He broke off and stared at the sheaf of music paper. "Artifacts! If those aren't made of radio-plastic there'll be a blow-out! There's *been* one by this time!" He began to hit buttons.

It was a deflated Hubingrath who left the Time Port half an hour later, the droning of a dozen lectures still troubling his ears. He had been made to feel like a murderer. The symphony, which he still carried, was a loathsome thing; crossing the park, he was minded to throw it into the Serpentine. But he had not, as yet, looked at it; he was still unable to deny himself the pleasure of sight-reading a Hubingrath symphony he did not intend to write.

The corner of Gore Mews was near the Albert Hall. As he approached it was with the impression that the hall had disgorged an especially large audience into the street. But the presence of several fire engines suggested other reas-

ons; soon he realised that the centre of attention was Gore Mews itself.

He found a familiar policeman who forced a lane for him.

"There it is," the policeman said. "There it *isn't*, I should say."

His flat had gone—it was as emphatically absent as a knocked-out tooth. The row of mews dwellings was interrupted by a blankness and a deep hole. Already the police had caused a rope barrier to be stretched along the hole's rim, over which people peered into the thirty-foot pit. On either side drooped ganglia of electrical wiring from the adjacent flats; a few water pipes still gushed like severed arteries. Of the fabric of his flat, of the bookish squalor and the musical muddle, nothing remained.

"Was anyone inside?"

"No evidence yet," the policeman said.

Hubingrath began to elbow his way into Kensington Gore, suddenly obsessed with the certainty that Miss Balsam had been reduced to electro-

magnetic energy. Heavens, he had left her his key!

He met her, face to face, at the corner. She said, irrelevantly: "Someone *so* kindly gave me a cup of tea."

It was later, amid the rationed comforts of a cheap hotel, that he remembered the symphony. He tossed it into her lap.

"See what you make of that."

"What is it?"

"My Tenth. I haven't read it, and I don't much want to now. *You* read it."

"What on earth do you mean?" she said. She took the sheaf of paper and there was a pause as she flipped pages. She said, wonderingly: "This was in the flat—had been for years. The one you wrote at eighteen—remember?—and never published."

Hubingrath sat down heavily.

"I remember."

" . . . the one I always thought you *should* publish. A minor symphony, but exquisite. A discovery of youth and love."

Men were wanted so the posters said——

Come to Prestonwell

by KENNETH BULMER

THE SKY WAS TALL AND heart-breakingly blue above the brilliant profusion of colour from tree and meadow and lake and far off haze of mountain. The white gleam of glass and concrete from the atomic power station nestling in the hills told of the friendly hand of man stretched out with the good things of life over this pagan paradise.

Colin Metcalfe reached up one hand to the top of the sky and quite brutally tore it down, flung tree and lake and hill to the floor and stepped on them, ground them down with trampling boots. He was breathing hoarsely and raggedly, like some wild thing at the end of a chase, and his fury and loathing and despair were altogether horrible. Beneath his passionate boots the poster's flamboyantly beckoning colours shredded and pulped.

"Take it easy, son. That won't help you any."

"Tricked!" Metcalfe flung his thin body round to face the man in the atmosphere helmet. "Tricked by you filthy ghouls!" Through the polarised glass of the dome above warm evening sunlight fell across his tortured face, glistened from the sweat line along his forehead.

The man in the atmosphere helmet spoke kindly, resignedly, like a patient teacher explaining a problem. "Try to understand the situation, Mister Metcalfe, see life, your life, against the galaxy as a continuing pattern——"

"Your promises were all lies!" Metcalfe flung a shaking finger at the poster, at the gay colours, the hypnotic wording——

"Look, darling, that's the place!" Colin Metcalfe

pointed excitedly at the gay poster. He dragged the laughing girl half off her balance, and she put her free hand up quickly to rescue her hat.

"Darling! You're not off there right away! Let me get my breath back."

Metcalfé looked at the pictured scene, his eyes shining. The girl looked at him, sighed, and slipped her arm round his waist. They stood there, oblivious to the bustle of the Emigration Bureau around them.

Tall blue sky, riotous colours of tree and meadow and lake and the far-off haze of mountains. A hint of white concrete and shining glass in the cleft of the hills, the atomic power station, providing good living and the luxuries of life. Below, in vivacious print:

PRESTONWELL INVITES YOU
TO BECOME A CITIZEN. LAND
FOR ALL! JOBS FOR ALL!
GUARANTEED EARTH LUXUR-
IES AND SERVICES. MEN WITH
ENTHUSIASM CAN MAKE
THEIR FORTUNES IN A YEAR.

BECOME INDEPENDENT!

"Make their fortunes in a year," said Colin Metcalfé.

"Become independent! That's for me!" He began to drag the girl towards the long glass counter where bored clerks dealt with enquiries. "Come on, Mera."

"What about this planet?" Mera stopped before a poster, halting Metcalfé in his eager rush. From the poster's indeterminate background a tall, rangy man stared arrogantly, long rifle in hand. Metcalfé snorted derisively.

"Elysium! Not likely——"

"They have two suns," Mera said, thoughtfully. "And the cat-venom brings in fantastic money. Less than a year on Elysium ought to bring in quite enough for us to get married on. I don't like the idea of your being away from Earth for a whole year, Colin. I'll be so lonely . . ."

"It won't be so long. And Prestonwell has far more to offer than messy cat-venom. There's a terrific scramble for their farm produce!"

Mera nodded, convinced, and left the poster advertising Elysium without a second glance. As they walked across the gleaming wood-block floor she listened to Metcalfé,

eagerly expounding on the prospects of Prestonwell.

"Old Earth's always been in a bad way for food," he said forcefully. "The Prestonwell concentrates and dehydrates they ship out take practically no bulk storage, yet on reconstitution on Earth—well, Mera, you know what Prestonwell food tastes like!"

"Mmm! Delicious!"

"And that's after it's been shot fifty light years through hyper-space." He paused just before they reached the pamphlet-strewn glass counter. His face clouded. "All the same—I wish we could afford for you to come out with me."

She smiled quickly and squeezed his hand, not allowing him to see the extent of her own disappointment.

"Don't worry about that, darling. We've just scraped the money for your passage—and the year will go quickly. I know it will."

"I love you, Mera," he whispered and turned as a clerk shuffled papers into a pile and raised bored eyes to the next applicant.

"Prestonwell, sir? Certainly. If you'll just fill in these forms.

Medical. Psycho. Heredity. Education. Oh, yes, and this disclaimer."

The clerk riffled the varicoloured forms across the counter to Metcalfe.

"Disclaimer? What's that all about?"

"The usual." The clerk glanced at the wall clock, and spoke more rapidly. "No insurances acceptable, just in case, you know. I can tell you that we never have any trouble with emigrants to Prestonwell. It's purely a formality."

"I see." Metcalfe didn't; but he had no wish to appear ignorant of any detail before Mera. Surprisingly, the girl spoke to the clerk, her clear incisive voice pulling him a little out of his professional lethargy.

"Do you have many people returning from Prestonwell before they have made a fortune? I mean, do you know of anything which might cause failure, anything that the authorities on the planet might wish to conceal?"

The clerk shrugged. "If they had, would I know of it?" As he saw the expression

on Mera's face he added, hastily: "We have one or two men come back from Prestonwell; not many. They all have reasons here on Earth for returning. Never a bad word for the planet itself, or the conditions, or the people there."

"That's a relief, anyway." Mera began to look through the forms with Metcalfe.

The Bureau of Emigration took two months of examinations, form-filling, medical and psycho check-ups before they decided that Colin Metcalfe was suitable as a candidate for emigration to Prestonwell. Even then, he was never sure just what apparently normal events of his life during that hectic two months were in reality concealed tests. They appeared sarcastically unimpressed by his high I.Q. rating. It seemed to Metcalfe that the officials were digging down even deeper than that, were trying to find from what basic materials his character had been built, were assessing him on a chart whose measurements were completely unknown to him.

The letter telling him he had been accepted came exactly one week before departure time.

"They don't want to give you any time for second thoughts. In case you back out." That was Mera's theory.

"Seems likely," agreed Metcalfe, ablaze with the fact that he was actually going. "Think of it, Mera! Out there, among the stars! Fifty light years. That trip we took to the Moon on the excursion ship is nothing to it. Right out, in deep space!" His eyes shone with the dreams of impatient youth, and Mera reacted to that urgent fire, bringing her womanly intuition to aid her in this time of parting. A whole year apart. They'd get through it, somehow.

Their leave-taking was stiltedly brief. Metcalfe could think of little else except the coming adventure, and Mera had passed the weeping stage long ago. Women of the Space Age had earned their equality with men besides demanding it. She stood with a little crowd of friends and relatives fluttering handker-

chiefs as the whining lift receded up the flank of the starship, the noise effectively preventing any parting shouts. The airlock closed.

On stilts of power the starship rose from Earth, transhipped to hyper-space and fled on its journey across fifty light years.

"Only a year," Mera told herself sternly. "And Prestonwell is a good planet. Colin will make out all right."

Looking through the polarised direct vision ports, Metcalfe gazed over the magic beauty of Prestonwell and was captivated, as were all the emigrants jostling him on the promenade deck of the starship, by the throat-catching familiarity of the scene. And yet, this new planet was even more life-size than old Earth. The green of tree and meadow, the blue sparkle of lakes, the majesty of soaring peaks, all seemed more vivacious, more alive, more full of promise for the idyllic existence desired by all men.

"Say, this little planet sure is a beauty!"

Metcalfe turned his eyes away from the captivating scene to survey with quiet amusement the fresh, freckled face of the youngster he had palled up with during the trip. He knew that the same enthusiasm was strong in his own face. The same eager expectancy that animated all the men and women waiting to disembark.

"If it's as good as it looks, Lane, it's paradise."

"Sure it is! Am I glad I chose Prestonwell, Colin. They nearly had me sold on Epictetus IV. I'm here to stay—wish you were, too. It's going to be a great life!"

"A gay life and a quick one," a new voice broke in. Charles Rattray, debonair, just growing a waist-line—physical workout every morning before breakfast—smooth, easy smile, regarded the naive enthusiasm of the younger men with a hint of patronising aloofness. Metcalfe, for no real reason except perhaps for a feeling of inferiority which infuriated him, had an aversion for Rattray.

"How come a smart guy

like you didn't make a fortune back on Earth?" enquired Lane tartly. He winked at Metcalfe.

"Made and lost, made and lost," replied Rattray absently. He gestured to the port. "Looks as though they intend to decontaminate us before we're allowed onto their precious planet."

Men were coupling a flexible eight-foot tube to the starship's airlock. The tube disappeared inside a low outer dome clustering on the edge of a huddle of domed buildings that extended over a number of acres. The transparent bubbles were polarised, Metcalfe saw, and he could make out little of what lay within.

Walking with the rest of the passengers through the tube into the dome and submitting to the usual decontamination procedure occupied an hour. During that time the excitement built up rather than decreased, and by the time they were all ushered through into Reception further delay seemed monstrous, as though the officials were deliberately

keeping them from the paradise of this world.

Lane noticed it first.

"Say, Colin," he said, a puzzled frown creasing his freckles. "This air here smells just like the ship's air."

"Canned," Metcalfe agreed, casually, not worrying about it.

So far they had not seen any inhabitants save for the men who coupled up the connecting tube. Metcalfe looked round the Reception dome with interest, dropping his suitcase beside a posture chair, and going from window to window. Outside the sun beat across the land, exactly as pictured in the posters on the wall, facsimiles of those which had first attracted him back on the distant Earth.

Rattray said, sneeringly: "I suppose they do want us on their blasted planet?"

Lane spluttered, but could find no suitable words. Metcalfe remained silent, gazing across the level fields to the distant mountains. It was very quiet.

"The quicker I make my pile and head back for good old Earth the better, you can

take it from me," Rattray said, flinging himself into a chair and lighting a cigarette. "Where the hell is everybody?"

"Perhaps we're being watched," said Metcalfe slowly. The idea had occurred to him as he turned back into the dome and caught sight of the loudspeaker high in the wall.

"Watched?" Rattray exhaled a plume of smoke. "What in hell for?"

"I don't really know. Perhaps some kind of test, a trial of our patience, anything like that." Metcalfe had grown so used to this vague but persistent feeling of being on trial during the period on Earth of waiting that it came to him now quite naturally. Lane nodded quickly.

"We could be, at that."

"No. I don't believe that." Rattray stood up and began to stamp about the room. His cigarette was consumed very rapidly and he immediately lit another. Other people in the dome were fidgeting now, glancing at their watches, talking in gradually rising tones indicating a restlessness

that infected them all imperceptibly, until the crackling and preliminary hum from the loudspeaker brought all eyes to focus upon it. Just like a stage of puppets, Metcalfe realised, and took his eyes away deliberately from the speaker box. A voice spoke, authoritatively, quietly, incisively.

"Malchang, Leon. Please go through the door marked Orbit one."

A man rose self-consciously from a posture chair, smoothing his sandy hair and pulling his tie straight. He began to walk towards the door, then shuttled back, picked up a tan leather suitcase and went out. The door shut with a soft click that sounded like a thunderclap.

Coinciding with the resumed hum of speculation, the speaker vibrated again.

"Czarnick, Petrov. Please go through the door marked Orbit two."

Czarnick was thick-browed, heavy-jowled, needing a shave. He went through the doorway as though meaning to find out just why he had been kept waiting.

Metcalf saw Lane wiping the palms of his hands down his trouser legs. The youngster did it surreptitiously. Rattray gave a short, hacking laugh, and began to walk up and down the room. His cigarette gave off rapid, uneven bursts of smoke. One by one some dozen men were called through the enigmatically marked Orbit doors. There were seven of them. Metcalf noted, without great interest, that the times of interview varied.

Lane said quickly: "If they don't want me, after all this, all this way, and waiting—"

"This is just cheap conditioning, son," Rattray said confidently. "All I want is to get out on those farms and grow me a crop to bring the money rolling in. Then, off to Earth and a gay life!"

"I want to . . ." Lane hesitated, then went on defiantly, his freckled face redder than usual. "I want to settle here, build up a home, make something of myself. You can sneer, just wanting a planet to get-rich-quick on . . ."

"I suppose that's all I. smooth plastic. Startled, he

want, too, Lane," Metcalf put in, quietly, without rancour. He was not very much older than this impressionable, dreaming youngster. "Just make enough to marry back on Earth—"

"You're different, Colin. I can't explain it; but I can feel it."

Rattray laughed in a way which, if the circumstances had been different, would have brought an instant challenge from Metcalf. As it was, he listened instead to the speaker telling the next man to go through the door marked Orbit six. Metcalf felt his gaze drawn irresistibly back to the view outside the dome. This was a wonderful planet—very wonderful; but it could never compare wonder and longing with old Earth. Earth had something that would draw her sons back long after they had shaken the stars of this galaxy from their shining ships. He stood up and walked slowly round the dome wall, gazing reflectively at the brilliant scene outside.

His shoulder touched

looked where he was going and found himself pushing against a narrow door set flush with the wall, leading through into the next curve of the dome. At that moment the speaker said: "Ratray, Charles. Please go through the door marked Orbit seven."

Ratray executed gracefully. His studied walk had a blase air that both amused and irritated Metcalfe. The man was such a good poseur that you felt he must really be what he pretended. He'd make money, that was sure. Metcalfe decided to talk to Lane, reassure the kid—he was sitting on the edge of a chair, tying his fingers into knots.

"Don't let this hanging about get you, Lane. There must be all of four hundred of us left to go—and you can't tell me we'll all be processed, or whatever they're doing, today. Probably show us food and dormitories soon."

"I sure am hungry, at that," Lane said, seizing that point of the conversation to cover his own anxiety.

"I should imagine that Ratray would make his pile

in less than a year," Metcalfe said, more to keep the atmosphere relaxed than because he was interested. "He strikes me as the sort who get what they want."

"You're right——" Lane began and the speaker cut across his words with the level incisiveness of a scalpel.

"Van Houten, Lane. Please go through the door marked Orbit seven."

Lane jumped. He stood up and smiled at Metcalfe, a sick, anticipatory smile. He swallowed. "Well, Colin, here I go."

"Good luck, Lane." Metcalfe watched the youngster across the floor and through the doorway marked Orbit seven. Then, before he had time to worry about himself, the speaker was announcing again.

"That is all the interviews for today, gentlemen. Will you please all go through the door marked Dorm One, where you will find food and beds. Interviews will commence at 0600 hours tomorrow morning. Goodnight."

A babel of sound broke out as men reacted according to

their natures. Eventually they were all shepherded through the door and sat at long, refectory tables. The food was magnificent, fresh; unconcentrated and reconstituted as was the Prestonwell food obtainable on Earth. Metcalfe could not help but make a good meal—nerves stood no chance against such food as this. The truckle beds were comfortable, and facilities adequate. Almost no time at all seemed to have elapsed before he was back in Reception, sitting listening to the speaker calling men for interview.

He whiled away the time reading magazines scattered on the low tables. Late on in the afternoon—Prestonwell was sufficiently Earthlike to have a twenty-six hour day and night cycle—he rose to stretch his legs and came again to the plastic door barring further progress round the dome towards the ship connecting tube. Thinking to catch a sight of the ship and see once again, perhaps for the last time before he went home, the vessel that had brought him, he pushed open

the door and walked through. The windows curved round and butted against the tube entering from the outside and going on into the Reception room. There was a door in the tube and a bye-pass going beyond it. He ignored that, looking at the front half of the ship, thinking back to the time when Mera had waved him goodbye.

The sound of footsteps coming from the bye-pass warned him that he had been daydreaming here too long. His name might have been called. He turned to retrace his steps when a voice halted him, a familiar condescending, blase voice.

"Hullo, Metcalfe. Sight-seeing?"

Metcalfe turned to face the newcomer. "I could ask you the same, Rattray."

"Ask away, old boy. I'm off for good old Earth. Prestonwell, perforce, must do without my company for a while."

"How's that?" Metcalfe was astonished. This was the man who had been boasting just how fast he would make his fortune. "What about—

that is, what about the object of your coming here?"

"That will have to wait. Other things have come up." Rattray looked very pleased with himself. "As a matter of fact, old boy, I've just had word that a company on Earth want me to come in as consulting director—at a fat fee. I did rather well coming here—made them realise what they'd missed. Luckily I'd taken a return ticket, so I'm going back with the ship." Metcalfe, watching Rattray, saw a sort of shadow, a heavy blankness about the other's eyes, as he spoke of his new job and his return to Earth.

"Well, that's very good for you. I hope you'll do very well."

"I shall, old chap, I shall. Prestonwell, farewell." Rattray waved a slim hand in a nonchalant gesture. He went through the small door into the connecting tube towards the ship. Metcalfe stood for quite a while, thinking.

He came to with a start, and rapidly made his way back into Reception. Everything appeared as before.

There were no signs that a man's name had been called without the man answering. Metcalfe picked up a book and sat looking at it without seeing it, thinking of Rattray's *volte face*.

He had reached no conclusions except that there was something very peculiar in Rattray's conduct, when his name was called. Going through Orbit three he saw immediately the familiar poster on the wall, a desk, a chair and a man sitting behind the desk. The man was wearing an atmosphere helmet, a transparent globe with armoured cables running to gas cylinders against the wall. The man's eyes were wide and blank.

"Mister Metcalfe, please put on the dark glasses you will find on the desk."

Metcalfe complied, saying: "What's the idea of that?"

A brusquely upraised hand halted him.

"Are the glasses on securely? Your sight depends on it."

"Yes."

"Very well, then, now I shall be able to see you."

With that the room, which had disappeared in darkness behind the tinted glasses, came into sight again. Metcalfe realised at once that the light in the room must have been increased to a prodigious level to enable him to see clearly through the dark glass. The man in the helmet blinked, then smiled. Metcalfe caught a feeling of friendliness, of understanding, from the man's lined, cheerful yet powerful face.

"You must be wondering what all this is about, Mister Metcalfe. The explanation is very simple. Prestonwell receives from its primary a great deal more light than does Earth from Sol."

Metcalfe's first thought was an irrational understanding why the done was polarised. That was the reason for the tremendous plant growth, the luscious food, the whole beauty of the planet. It took him a little time—during which the reception officer sat perfectly quietly—for him to come to the real kernel of the problem. He half rose from the chair.

"But—I need glasses to protect my eyes in this il-

lumination. You must have de-polarised the ceiling here. *Why don't you need glasses?"*

The man's smile was very warm, very friendly.

"I'll tell you, Mister Metcalfe. By the way, my name is Carlin. My eyes have been adapted. The Fovea has been slightly protected by blood cells, the rods have been blunted as to their light sensitivity, the cones remaining almost unchanged except for greater protection. Thus I am able to see perfectly, my brain receiving an understandable image from my eyes, which accept far more light than they were designed to do." Carlin chuckled. "It is fortunate that Prestonwell possesses no less than five moons, each of which is able to give enough light for my poor blunted eyes to see by at all phases of Prestonwell and the sun's positions."

"Otherwise you'd be blind at night," Metcalfe said in-
anely, reacting along the line of thought indicated by Carlin, completely unable for the moment to think this thing out for himself.

"We cannot see very well

in bad light—but then, there is always an abundance of light on Prestonwell.”

Metcalfé licked his lips. “Then, if I want to work on Prestonwell, I’ll have to have my eyes adapted?”

“That is so. You could work for a while with dark glasses; but there are other factors to contend with.”

“Well,” Metcalfé forced a smile. “That’s not so bad. It doesn’t appear to have harmed you. And the operation doesn’t sound too bad. I could stand the idea of abnormal eyes for a year.”

Carlin coughed slightly, deprecatingly, his breath clouding the helmet directly before his mouth. “You are one of those who have come to Prestonwell in order to ‘make your fortune.’ You then intend to return to Earth?”

“That’s right.” Metcalfé was recovering now. The idea of surgeons playing around with his eyes wasn’t nice. But the prize was worth it. “I’ve a girl waiting for me on Earth. We plan to get married on what I can make here.”

“A worthy object.” Carlin shot his question like a soaring rocket. “Why did not your fiancée come with you?”

There was no embarrassment in admitting it. “Finance. We just scraped enough for my fare here.”

“Ah, yes. You did not buy a return ticket. That makes things very awkward.”

“How so?”

Carlin by-passed that question. He went on quietly speaking. “The operation to transform your eyes into organs suitable for life on Prestonwell is an irreversible process. You could not be re-adapted for the light from Sol.”

“That’s a pity,” Metcalfé said. He was sitting up very straight now. “But I could last a year wearing dark glasses. What is all the mystery?”

“There is no mystery, Mister Metcalfé. Simply that here on Prestonwell we are trying to build a new Earth, a fresh seeding of mankind, in conditions which, although slightly different from Earth, are, nevertheless, very similar.”

"You mean you want people here like Lane, people who want to stay and colonise. You're not really interested in people like me who want to make money to return to Earth."

"If you wish to phrase it in that way—yes." Carlin nodded his head, the atmosphere helmet catching gleams of light from the ceiling sunshine. He looked like a man approaching a delicate problem, knowing what he had to say, and half-regretting its necessity. Metcalfe could think only that he was here to earn enough to marry Mera.

"Listen, Mister Metcalfe—this planet is a very wonderful place——"

"I know." Metcalfe cut him off rudely. "I want to make money and get back to Earth. Perhaps you'd kindly get on with my acceptance here. I'll agree to wearing dark glasses."

Carlin sighed. He raised one hand and gently tapped the transparent curve of the atmosphere helmet. His lips were compressed, yet their ends curled upwards and his eyebrows were raised. Unwillingly, Metcalfe met that

challenge: his mind resolved the tapping finger and then tried to refute what logic brought so plainly before him.

"I'm afraid so, Mister Metcalfe." Carlin's voice was very gentle.

"But surely——" Metcalfe spoke impulsively, out of the necessity of meeting this thing at once, spoke at random. "That is—well, I could wear a helmet like yours—that is, I mean, one that has air like this——"

"Yes, you could wear an atmosphere helmet outside on the surface. You could carry around on your back gas cylinders to give you a normal Earth atmosphere in the helmet." Carlin leaned back in the chair and his helmet went *chink* on the headrest. "There's even something on the credit side of the ledger. We have a superabundance of oxygen on Prestonwell which means that you need only carry nitrogen, or helium, depending on which you can afford to buy, and bleed the outside air into your circulatory system."

"All this means," Metcalfe

was regaining his faculty of thinking—something he was afraid he had lost—"that I must wear an atmosphere helmet and glasses outside to do my job. Sure, that's an inconvenience; but I do not see that it is an insuperable obstacle. And I guess that you find most people regard the position in that light."

Carlin twiddled his fingers. He shot Metcalfe a level glance under downdrawn brows. "Most people," he said deliberately, "I am very glad to say, do not accept that position. We have a high incidence of genuine immigrants here."

"Well, I'm after making some money. Tell me where I draw my glasses and atmosphere helmet and——"

"You misunderstand me, Mister Metcalfe. If you persist in this course, then I must point out that it is up to you to provide the glasses and helmet."

"Where do I get them?" Metcalfe said through his teeth.

"We have stores and shops, just like any civilised

world——" The sarcasm was not lost on Metcalfe—he rose from his chair.

"Let's get started then." He had a strong feeling that, somehow, he was in the wrong. It was irrational—after all, these people had got him here under false pretences—but the conviction that basically Carlin was a genuine person with more than a superficial friendly interest in him had grown stronger, and, because Metcalfe was merely human, he reacted by behaving in an even more uncharitable and uncharacteristic manner. Even whilst he was being rude to Carlin, he was already regretting it.

Carlin said: "I'm sorry, but we cannot allow——" And then he stopped as a wall speaker clucked softly and said a sentence that made Carlin smile in a great beaming grin of good humour.

The speaker had said, simply: "Allow Mister Metcalfe to proceed. It should prove instructive."

Going out through the rear door of Orbit seven, Carlin unclipped his bulky gas cylinders from his helmet

and coupled in a smaller cylinder which he slung across his shoulders. "This is the sort of thing you'll have to carry about outside all the time." Metcalfe grunted. He was wondering what was going to prove instructive—and to whom.

The shops had glassed-in fronts opening onto the outer world, with other counters facing inwards towards the dome corridor, where the polarity of the dome made a sharp line of demarcation. Carlin stopped before the gleaming shop counter where he had a quick and, to Metcalfe, unintelligible, conversation with the assistant. An atmosphere helmet was produced and after some delay a small bottle of nitrogen.

"All we have here at the present time," the assistant apologised. "We'll be having some helium cylinders in shortly. I've had instructions about payment—in this case it's to be by instalment——?"

"When Mister Metcalfe has a job," Carlin said gravely. "He will repay you interest for the loan of the equipment and

pay off the cost." The assistant agreed this, obviously having received prior notification from the person who expected to see something instructive, and Metcalfe and Carlin moved off. Carlin showed Metcalfe how to operate the helmet, and they went through the polarised line of demarcation. Airlock doors opened and closed and Carlin gave a gushing sigh of pleasure and removed his helmet.

"Am I glad to get that thing off! Righto, we'll go along to the employment bureau and find out what jobs there are for you."

Metcalfe had to hurry his pace to keep up with Carlin. The helmet began to chafe his shoulders almost at once and the hissing suck of the air going in and out, in and out, rapidly became a maddening monotony. He'd grow used to it, he supposed, although the nitrogen taking the bled-in Prestonwell air to his lungs ought really to be helium. It remained to be seen whether he could afford it.

"Hold on a minute, Carlin

—I can't keep up with you in this damn goldfish bowl."

Carlin's reply, tinny now in the phones with a different timbre, shook Metcalfe. "I'm walking quite slowly by Prestonwell standards, strolling, really. It's probably the extra oxygen. Our lungs have been adapted well enough, although we still can't synthesise hæmoglobin, and we accept only the amount of oxygen our lungs require—yet there still seems to be wine in the air."

"It'd burn my lungs up, right?" Metcalfe panted.

"Right. You'd get an oxygen jag that would make any drug and drink orgy look like the Sunday School picnic—and then you wouldn't have any lungs left. Look, there's the Employment Bureau."

They had come across the blue-green grass, with the dome area falling away behind and now they saw across the sun-drenched flower beds and lily ponds the low white Employment building. Water hissed merrily from rotating sprays on the lawns where pert, painted birds strutted and preened. It was very

warm and soothing, and altogether lovely.

Metcalfe, panting along in his ugly atmosphere helmet, eyes covered by dark glasses so that he looked like a leprous blind-man, felt the incongruity of his appearance, felt he was out of it, and made up his mind to be as damned awkward in his turn as he could be. They passed a shrub flowering by the door and Carlin raised his head, his nostrils dilated slightly to his indrawn breath.

"Man!" Carlin said, exhaling and seeming to shake all over. "What a scent that shrub gives—oh, sorry, you can't—come on in and we'll find a job for you."

Going through the swing doors into the blue-barred sunshine within, Metcalfe asked Carlin: "How much do I owe for these ornaments I'm wearing?"

"The helmet's a couple of thousand and the goggles are being chucked away at a hundred."

The helmet price was too unreal for Metcalfe. He seized on the price he could understand. "A hundred for a

pair of goggles—you must be crazy!”

“We don’t use ’em here, Metcalfe. Odd pair for welding—and the pairs in Reception. You have to pay for transport over fifty light years, and a hundred is cheap.”

“Well, gents, what can I do for you?”

Metcalfe turned at the words, seeing a small, shrewd-eyed fellow in black, an inky ball-point leaking away behind his ear. He was smoking an enormous Meerschaum. For some reason Metcalfe wanted to laugh; then he sobered instantly. This fellow’s little eyes betrayed no surprise at seeing a man in an atmosphere helmet. That could mean a number of mutually exclusive things. Carlin, carefully avoiding the Meerschaum’s effluvium, opened the conversation.

“Jobs?” answered the clerk. “Well—there are plenty of jobs going. If you go through the end there you’ll find a dozen impatient farmers taking on men from this latest immigrant ship.” He looked askance at Metcalfe’s helmet. “Employment is entirely up

to the farmers themselves. They like your looks, you’re in and you can make big money and set up your own farm. You got the wrong-fitting face and, well, Employment Bureau clerks don’t do too badly.” He sucked the enormous pipe. “So long as I’ve got me bit of baccy from the farmers, old Betsy and I’ll get along.”

“Betsy?” Metcalfe said stupidly; then, as he saw the little man’s outraged expression: “Oh, I see.” He pulled at Carlin. “Come on. I want that job.”

“You’ll have to earn big money to repay the loan for your helmet and goggles, Metcalfe. More than that employment clerk gets, for all his cheerfulness. And then, if you want to make enough to get married on and to pay your fare back to Earth——” He paused as they came out into a wide room where farmers lounged in chairs reading and smoking. “It can be done, Metcalfe, I suppose, looking at the problem dispassionately. But how long——?”

The last words were all

but drowned by the farmers' growling greetings, from which Metcalfe gained a strong impression of the words "helmet and goggles" predominating. He began, quite suddenly, to feel fear; for the first time, as that inarticulate mass of sound came from these men, he realised just what he was trying to do, the odds he was taking on. That feeling increased as the farmers, calmly, in their turn, rejected him as unsuitable for their employment. The two thousand one hundred for the helmet and goggles began to double and treble in size as the farmers, one by one, turned him down.

By the time the last two came forward, Metcalfe was desperate. He was trembling all over and he was forced to rub his forehead against the sweat pad in the helmet time after time; even then, some sweat ran down and stung his eyes.

"Sorry, son." The farmer spoke unemotionally. "You'd be too much of a handicap on the farm. Sorry."

"But, mister, please——" Metcalfe was blurting the words out before he was

aware that his lips had moved. He shut his mouth obstinately and swallowed. The last farmer looked at him.

"Well?" Metcalfe said. "I can work in this damned helmet. I can work, I tell you!"

The farmer pursed his lips. He had a ruddy, kindly, well-fed face, the face a dog would love.

"Well, son, I'm afraid that you just wouldn't last on the farm, not with that contraption on your head. Where would you get your artificial air from? We're right up in far valleys, hundred miles to town. Sorry, son."

From that, Metcalfe picked one thing. "It's not artificial air," he said dully. "Mine is real air; yours is the artificial stuff. Poisonous." He tried to stop himself from laughing, and succeeded until they were back outside, among the flowers and birds and warm, pleasant sunshine.

"It's useless your thinking of getting any job other than on a farm for big money," Carlin was saying.

Metcalfe was shaking with

silent laughter now. Carlin looked at him suspiciously, then took his arm and guided him as fast as he could walk through the flower beds and across the blue-green grass back into the domes and so into the little room of Reception.

With their helmet roles reversed, some of the nightmare of the situation returned intensified to Metcalfe. He felt like an animal at the bottom of a pit trap. Things would work out all right, he had thought only recently; but now, now he was face to face with the fact that things most certainly were not working out for him.

"I should have gone to Elysium," he said bitterly.

"Elysium?" Carlin laughed.

For some reason that made Metcalfe think of Rattray.

"If I didn't want to stay on Prestonwell, and I had already a return ticket or the money to buy one—would I be allowed back to Earth?"

Carlin appeared shocked. "Of course. We could not detain you against your will. You must pay, however, a

sum to cover the value lost to us of foodstuffs your body weight replaces on the trip to Earth. The return fare is high."

"I know. But—you *do* something to people going back."

"We merely ensure that they return for reasons unconnected with anything to do with conditions on Prestonwell."

"Like you hypnotised Rattray. The clerk back on Earth said nobody ever complained about Prestonwell. You're damned clever, the lot of you. Your eyes and lungs messed about with, and anything else that I wouldn't know about for that matter. And you want to do that to me—well, I'm not having any, hear? I want out—back to Earth. Quick."

Carlin hid a smile. He spread his hands on the desk and studied his nails.

Presently he said: "You can go back to Earth on the ship you came here in, if you pay the fare. Surely that's fair—recompense for the food we can't send to Earth because of your weight?"

"I haven't got the money, you know that! No one on Earth I know has it, either."

"You can't get a job here to pay for the equipment you need to carry out that job, and, therefore, you certainly can't earn your fare home." Carlin looked at his wrist watch and then flicked a cautious eye over his gas meters. "What are you going to do, Mister Metcalfe?"

"If you think I'm going to settle down here, you're mistaken!" Metcalfe shouted it, tried to cover up his own abysmal fear and weakness. "I've got to get back to Mera!"

Carlin shrugged. "I'm going to eat. I suggest you go through to the Dorm room and think things over. I'll call you in a couple of hours."

Metcalfe went through to the Dorm room—arousing a buzz of curiosity from the few remaining men in Reception—and ate. Then he stood by the windows, looking out into the brilliant evening sunshine. Shadows stretched like cool beckoning fingers towards him from the trees, and this world, so beautiful

and desirable, aroused an ache in him.

"Stinking air," he said aloud, mouth down-drooping and eyes dull. "Burning sunshine—God, what a mess!"

He was alone now, in the broad emptiness of Reception. A single cigarette sent a long unwavering scar of smoke into the still air. Magazines were open on tables, chair cushions still dented. The place smelt dead.

Metcalfe beat a hand impotently against the dome. Poor Mera! When they'd planned, and hoped he'd be picked, they had never foreseen this devilish smash of life. He wanted to be sick.

A shadow moved on the glass. He looked up tiredly and saw Lane standing outside, a Lane with a broad smile on his freckled face, strong, upright, brimming with energy. The youngster stuck his thumb up, waggled it and formed words with exaggerated care.

Metcalfe read: "Come on in—the water's lovely."

Lane glanced swiftly over his shoulder, swung back and repeated the thumbs up, and

darted swiftly away across the grass. Metcalfe was glad that the eager youngster hadn't caught the aura of gloom around him. He hadn't moved at all after seeing Iane, standing there, like a ghost heaving up from the past. If only life was as simple as that for him!

And fifty light years away a girl was waiting for his first message telling her of his exploits and of the cash he was salting away for their wedding.

He couldn't go back to her. He couldn't make money unless he was operated on, then he couldn't go back to Earth because, there, he would be under similar difficulties as he now was here on Prestonwell. There just wasn't any way out.

His name came from the speaker. This time just: "Colin Metcalfe. Orbit three, if you please."

He walked across woodenly, his emotions frozen, opened the door and saw Carlin in his atmosphere helmet sitting smiling at him. Metcalfe went inside, numb, unfeeling, not really caring any more about

anything. The evening sunshine slanted into the room and Metcalfe put the goggles over his face. The light vanished, then brightened back to normal.

The first thing he saw was the poster.

It flaunted its colours at him, mocking, deriding, fouling his hopes and ideals and dreams shared with Mera. He broke the barriers of emotion. He was shaking uncontrollably. He reached out a hand and tore the poster down, stamped on it, pulped it into shreds. He was gasping horribly.

"Take it easy, son. That won't help you any."

"Tricked! Tricked by you filthy ghouls!"

Carlin spoke kindly, helpfully, as he must have done a thousand times before. "Try to understand the situation, Mister Metcalfe, see life, your life, against the galaxy as a continuing pattern——"

"Your promises were all lies!" Metcalfe pointed down at the remains of the poster on the floor.

"Just a minute!" Carlin's grim tone shocked Metcalfe,

stopped him in mid-babble. He stared at the citizen of Prestonwell and something he saw in that firm face made him listen.

Carlin said, decisively: "The galaxy is a big place, Metcalfe, a very big place. Earth is seeding planets as fast as she can, spreading her sphere of influence and building up ties of friendship with the new worlds; there's nothing of Empire and colony about the process. Prestonwell is a good planet, if you change men a little to adapt. We changed willingly. We knew that here was our new home, that Earth was overcrowded, under-fed, and we were glad to have the chance offered to us of settling here. Why, Metcalfe, don't I go out and farm and make a fortune?"

"Why—I—that is——"

"Precisely. You cannot conceive of a man who doesn't want to make money. Of a man who doesn't think that money is the only thing in life. I love Prestonwell, Metcalfe, and by God you're not going to come here whining and spoiling it for me!"

Carlin's eyes were shining. "Now—we can bring your fiancée here——"

"Talk sense!" Metcalfe flung the words from him out of his feeling of shame. "If I can't afford to go home, then she can't afford to come out, even if the fares are different. I told you, we spent every penny sending me here, to this hell!"

"This is no hell, Metcalfe! I'd ask you kindly to refrain from insulting my home planet."

"I'm sorry! But, as far as I am concerned, this place is no better than hell. If you could bring Mera out, well, she'd jump at the chance, I expect——"

"Exactly. We want men and women who want to start a new life. We can offer many things that Earth cannot, even though we have nothing to compare with Earth's greatness of culture and tradition. I know you want to go back to Earth, Metcalfe. I know why. But you'll have to regard yourself as an unwilling colonist—something like the convicts

who were shipped to Australia."

"I'm a convict, am I?" choked Metcalfe.

"Sorry—a clumsy analogy." Carlin laughed, then stood up and came round the desk, trailing his hose. He clapped Metcalfe on the shoulder. "We'll bring your fiancée—Mera?—out here. Free. You two can start together, begin a line of Metcalfes that will one day be big people in the destiny of Prestonwell."

"Free?" Metcalfe groped. "But how——?"

"From Earth, all we want is good human blood. We send the food back to breed it. It's a simple cycle."

Metcalfe thought of Lane. The boy had been bubbling over with enthusiasm, an enthusiasm which seemed to have been increased by the operation and his emergence onto the surface of Prestonwell. Metcalfe began to see a glimmer of light.

Mera would come. She'd come, knowing the details or not. Metcalfe was convinced of that. And his own hands were tied—this was the only way.

He said to Carlin: "Seems

as though I'm to become a citizen of Prestonwell, whether I like it or not. I'd always hankered after seeing the Pyramids and the ruins of Knossos; that's done with now."

The sun slid below the horizon, and three moons gleamed silver and gold in the darkling sky.

"You know," Metcalfe said, "I think I'm going to like being forced to remain on this planet."

The Man Who said XIIPXERTILLY

Continued From Page 41

home. Upon entry, he found his house deserted, and, distraught, Henry spent two days searching for his wife, to no avail.

Sitting disconsolately by the fireside, in the early evening, he heard the door latch click. Turning round, he saw Mrs. Green, eyes glazed, enter the room. She was clad in a strange grey fabric suit. Advancing slowly, she stopped a few paces from him.

Henry jumped up excitedly: "Darling, thank Heaven you're home. Where have you been?"

"XIIPXERTILLY."

A second later all the neighbours were attracted to their windows by the maniacal laughter of Henry Green, who was running down the street shrieking.

"Oh, no! Help—not her! Off on the merry-go-round again..."

They had everything they could want except one thing—
and that made the planet an—

Unwanted Eden

by ERIC WILDING

THERE WERE FIVE IN THE cabin when it happened.

Old Sam had just shuffled the cards ready for the deal when they felt the familiar, sickening lurch as the ship emerged from hyperspace into the normal continuum. Together with the lurch came a stench of burning metal, the shrill of the alarms and the dull thud of automatic bulkheads slamming across the passageways. The lights flared and died, flared again, then went out to be replaced by the dull blue glow of the emergencies. A wall geiger chattered with mounting intensity, fell silent, then chattered again as the radiation died. It became very quiet.

"What's happened?" Gloria Prentice, young, blonde, an entertainer on her way to the

boom town on Sirius IV, whitened beneath her make-up. "Bill! What's happened?"

"How the hell do I know?" Bill Markhouse, tall, thin, stoop-shouldered, a commercial traveller and an opportunist, smacked his lips over the sour taste of too-much radiation. "Something blew, that's for sure, but what?"

"Maybe the pile went?" Fred Simpson, no longer young, gripped his brief-case with the instinctive gesture of a man who had worshipped that particular fetish for the past twenty years. He looked at the schoolteacher. "Could it have been the pile, Miss Kirch?"

"Nonsense!" Phœbe Kirch spoke with the full authority of middle age. "Accidents like that don't happen. Anyway, this ship was passed as space-

worthy by the Board of Control. I made sure of that before booking passage."

"Accidents can happen at any time," said Sam quietly. He riffled the cards between his gnarled hands. "Nothing we can do. The crew's on the job and we'd only be in the way." He dealt out the pasteboards with practiced ease. "Jacks openers."

"Who wants to play poker!" Markhouse jerked away from his seat and stepped towards the door. "I'm going to find out what's happened."

"Sit down!" Sam didn't move but the tone of his voice stopped the young man just as he was about to leave the cabin. "You won't get thanked for it and you might be running into trouble." He jerked his head towards the wall geiger. "Hear it? For all you know the ship might be rotten with radiation. Sit down and take it easy until someone comes."

"Suppose that they don't come?" Gloria nervously licked lips that looked black in the dull blue lighting. "Suppose that they're all dead or something?"

"Suppose that you grow up," snapped Miss Kirch sarcastically. "Everyone knows that the first duty of any crew is towards the passengers. Of course they will come. I expect they are busy at the moment."

"That's it." Fred Simpson hugged his brief-case and smiled his relief. "Perhaps it's just some kind of routine drill or something." He looked hopefully at the old man. "They do have drills, don't they?"

"Sometimes." Sam carefully picked up the cards and returned them to his pocket. "This your first space flight?"

"Yes. I'm on vacation, been saving up for it for years, and I'm going to visit my married daughter on Sirius IV." He touched his brief-case. "I'm not wasting my time, though. Head Office granted me the time off on condition that I made a preliminary investigation as to the prospects of opening up a branch office there." He smiled. "I'm with Interstellar Finance, you know. They might even make me assistant manager if they decide to open a new office."

"Why not manager?"

"Eh?" The little man blinked. "Well, I'm not really suited to be a full manager. I . . ." He broke off as a man entered the cabin.

He was an officer, that much could be told by the braid on his shoulders, but the rest of his uniform looked a mess. He leaned against the edge of the door, his face ghastly in the dim lighting, and when he spoke his voice was utterly devoid of any life or feeling.

"We've had an accident," he said dully. "The order has been given to abandon ship."

The lifeboat was small but even then it could have held more than the six people who were in it. Sam took a seat next to the officer and, after they had blasted away from the wrecked vessel, asked the obvious question.

"Where are the others?"

"Dead." The man's voice was still dull. "The pile went and collapsed the field. You people were lucky. Your cabin was right next to the cargo holds and we were

carrying heavy metals." He glanced at the screen and adjusted a control. "We came out near a big sun, its gravity field may have had something to do with the accident, and one of the planets is listed as being habitable. I'll set you down there."

"And then what?" Markhouse thrust himself forward. "When do we get rescued?"

"Sometime." The officer sounded as though he couldn't care less. "You can start the radio after we land and send out a signal. It might get picked up."

"Will it take long?" Simpson gripped the brief-case and looked worried. "Head Office weren't too keen to let me go and if I'm away too long they might replace me."

"Shut up!" The entertainer elbowed the little man to one side. "What about my contract? I'll sue this shipping line for every credit they've got! I should have known better than to book passage with a third-rate cargo ship to start with. I . . ."

"You were broke like the rest of us," snapped Sam.

"Stop whining and thank your stars that you're still alive. It's more than the rest of the crew are." He looked at the schoolteacher. "How do you feel, Miss?"

"A little sick," she confessed. "The excitement, I suppose, I'm not used to it." She swallowed and looked hastily around.

"There's some bags in a compartment in the rear." The officer didn't look round. "Can you operate a ship, old timer?"

"No." Sam stared hopelessly at the controls. "I'm a rock miner, asteroids and planetoids mostly. I heard of the new strike on Sirius IV and thought that I'd get me a job."

"Too bad." The officer vomited with a suddenness and violence terrible to watch. He wiped his mouth on the grimed sleeve of his uniform jacket, disregarding the mess before him. Sam glanced at the others, each busy with their own thoughts, and hunched himself a little closer.

"Bad?"

"Twelve hundred rontgens."

"And us?"

"I don't know. A fair dose around a hundred, I think, or maybe more. The shielding saved you but a stray shaft may have penetrated between the bales of heavy metal." The pilot glanced to where the schoolteacher was busy with her paper bag. "She may have caught it or she may just be scared. I don't know about anyone but me. That's why I asked you if you could handle the ship."

"I can't." Sam looked helplessly at the officer. "Can't you set her down fast? Before . . .?"

"I'm trying." The officer vomited again and sagged against the back of his chair. "Damn it! I was going to get married at the end of this trip." He stared glumly at the ranked controls. "I was never lucky. We cut cards to see who would pilot this ship and save the passengers. I lost. The rest of them took the easy way out."

"Anything I can do?"

The officer shrugged and, watching him, Sam knew just how he must feel. A lethal dose of radiation was 525 rontgens plus or minus 75.

The officer had been exposed to 1,200 and, literally, he was as good as dead.

Sam only hoped that he would be able to land the lifeboat before finally passing out.

They landed at dawn on a rolling plain fringed with trees. They landed with sufficient force to split the hull and turn the interior of the ship into a litter of twisted junk. Behind them a tortured furrow wended towards the trees and the heat of their ineffectual braking blasts had started a number of small fires in the dry vegetation.

Sam, because he had seen what was coming, had managed to shield his head and face and, as soon as the ship had stopped rolling, sat up to look around. The pilot was dead, his neck snapped by the force with which he had struck the instrument panel, and Fred Simpson, the little man with the brief case, had followed him into the realms where his fetish couldn't follow.

Miss Kirch was conscious

and moaning from the pain of a broken leg. The other two were, surprisingly enough, unharmed.

Later, when they had splinted the leg of the injured woman and salvaged some food, they tried to make plans.

"The first job," said Markhouse importantly, "is to get the radio working. The quicker we get picked up the better."

"The first job," corrected Sam grimly, "is to bury the dead."

"The dead can wait. Damn it, man, we might just miss contacting a rescue ship in the time it will take to plant them." He looked at the girl. "Is that right, Gloria?"

"Sure. If I don't get to Sirius IV on time they'll void my contract." She brushed dishevelled hair from her petulant features. "Rescued on time or not, I'm still going to sue the shipping company. This is a hell of a way to treat a paying passenger."

"See?" Markhouse smirked at the old man. "Radio first, burial second."

"Fair enough." Sam jerked

his thumb at the wrecked lifeboat behind them. "The radio's inside. It's probably smashed, but maybe you can fix it. The pilot's inside, too. He got a heavy dose of radiation and has probably started to decompose already. If he hasn't it won't take long until cellular breakdown begins to make him smell a little." Sam shrugged. "Maybe you don't mind working with a couple of dead men watching you."

"Me?" Markhouse shook his head. "Not me, you."

"How's that?"

"I don't know nothing about radios. I'm a commercial traveller. I sell advertising signs, some of the best on the market, but I can't mend a broken radio."

"Can you?" Sam stared at the girl. "You work in the entertainment field. Can you mend a radio?"

"No."

"Nor me." Sam shrugged. "I'll have a try but don't rely on it." He sucked in his lips. "Better help me carry out the bodies. I don't like working with dead men."

Markhouse didn't like it but there was nothing he could do. Gingerly he helped the old man carry the two bodies towards the fringe of trees. They had no tools with which to break open the ground, so they "buried" the men at the foot of a writhing bole, scraping a thin covering of leaves over them. Returning to the ship, Sam tried to operate the radio.

It was hopeless from the start.

The instrument, like most modern instruments, was a self-enclosed box sealed and tested at the factory. It probably contained printed circuits, transistors, pre-set tuning and scaled-down electronically-shielded tubes. To Sam it was a mystery. He stared at it with baffled helplessness, not knowing whether it was working or not and without even the knowledge to test it. Markhouse, seething with impatience, stood beside him.

"Well?"

"If this was a rock drill," said the old man slowly, "I could do something with it."

"It isn't a rock drill, it's a radio. Is it working?"

"I don't know."

"Then couple it up and find out!"

"Couple it to where?"

Sam pointed towards a writhing mass of leads revealed when he had unscrewed the radio.

"Tell me which ones carry power and I'll have a go. As far as I can see everything except the batteries cut out when we crashed. Nothing electrical is working, the lights, the air conditioners, the meters, nothing."

"You must know which leads were coupled to it when you unscrewed it." Markhouse swore as he touched a wire. "Something in this one, anyway; damn near electrocuted myself." He cautiously touched the rest of the wires. "Here, try hooking it up to these."

Tensely he waited while Sam attached the selected wires. For a moment nothing happened, then a faint crackle came from the box, accompanied by the smell of burning.

"You're wrecking it!" Markhouse snatched away the

wires. "Why the hell did you unscrew it in the first place?"

"I switched it on and nothing happened," said Sam defensively. "I didn't know if it was working or not. I thought that I could tell if it was broken and, if so, fix it."

"You've fixed it all right." The young man glowered helplessly around the litter in the cabin. "I wonder if they carried a spare?"

"I doubt it. They wouldn't want to load the lifeboat too heavily." Sam shrugged. "Anyway, the radio wouldn't have been of much use to us. It could only send out a distress signal at light velocity and it might have taken years until a ship could pick it up and come for us."

"How's that?" The young man blinked. "The pilot said . . ."

"The pilot was dying. He knew it and didn't give a damn. Why should he? We weren't his responsibility."

"The schoolteacher!" Markhouse snapped his fingers. "She should know. They teach electronics in schools, don't they?" He

grinned. "We'll let her worry about it."

But Miss Kirch had other things to worry about.

She lay on the dry grass, her splinted leg propped on a folded jacket, and her pain-drawn features bathed with sweat. She had been sick, not once but often and, as he looked at her, Sam was reminded of what the pilot had said about stray shafts of radiation. He gestured to the others and led the way out of earshot.

"She's in a bad way," he whispered. "I think that she must have got a heavy dose of radiation."

"But she'll get over it?" Gloria whitened as she looked at the schoolteacher. "We were all in the same cabin. If she got it then we got it, too. Bill! Do something!"

"Take it easy." The young man slipped his arm around her shoulders. "If we'd been poisoned we'd have known it by now." He looked at the old man. "Is that right?"

"Partly. We could have been affected in a minor degree, but it's nothing to

worry about." Sam bit his lip. "As far as I can remember she should be having blood transfusions. That, together with plenty of good food and rest, is all we can do."

"She can have some of my blood." Markhouse unbuttoned his blouse and bared his arm. "How are you going to give it to her?"

"I don't know," admitted Sam. "I've never had a transfusion, have you?"

"Once. They stuck a hollow needle in my arm and hooked up a bottle of plasma." The young man frowned. "Couldn't we put some blood into a jar, hang it up high, and then feed it into her that way?"

"We could try." Sam looked at the girl. "Have you any ideas, Gloria?"

"Couldn't we just run a pipe from Bill's arm into hers?" The girl looked anxious. "I read once something about different blood groups. I suppose that wouldn't come into it, would it?"

"Let's find out." Sam turned towards the wrecked lifeboat. "There should be a

medical kit and manual somewhere. Maybe it can tell us what to do."

It didn't.

There was a manual all right, a neatly bound, professional-looking volume containing a great deal of information as to which drugs to inject when. They even had the drugs, a selection of colourful ampoules, together with hypodermic syringes, adhesive tape, bandages, burn dressings, plasta-film coverings, rubber gloves, some scalpels, sutures, clamps, nylon thread and sterilised needles and an assortment of other, undoubtedly essential, equipment. But nowhere could they find a simple test to determine blood groups.

Bill swore as he threw down the book.

"Damn them! Did they expect no one but doctors or nurses ever to be stranded? What's the good of this stuff to us?"

And that was it. A doctor wouldn't have needed the information. A nurse could have managed without it, even a person skilled in first

aid could have made do. But Sam was a manual worker, Gloria a dancer, Bill a salesman. None of them even knew where to start.

"You splinted her leg," said Gloria to Sam. "You must have had *some* training."

"I had a broken leg once," said the old man. "I remember what they did to me and, anyway, you learn to do things like that in mines." He looked helplessly to where the sick woman rested on her bed of pain. "What can we do for her?"

"We can drug her." Markhouse looked up from where he stared at the ampoules and syringes. "There's morphine and novocaine. How about morphine?"

They tried morphine. It rid Miss Kirch of her pain and threw her into unconsciousness, but it did nothing to help her in her struggle for life. Night came with a tropical suddenness and they carried her into the shelter of the vessel. Dawn broke ten hours later and they woke to the sound of her sobbing. More morphine and she quietened again.

Then they reviewed their own position.

"We've got the ship," said Sam, "and we've got ourselves. That's all. Rescue may come or, most likely, it won't. If we hope to live we'd better start finding out a few things about this planet."

"The pilot said that it was listed as habitable," reminded Bill. "We shouldn't have a lot of trouble."

"Habitable means simply that we can breathe the air, that it's got water, and some Earth-type vegetation." Sam squinted towards the fringe of trees. "It could also have animals and insects—big animals and dangerous insects." He looked at Gloria and jerked his head towards the young man. "I think that we can find out about the animals. You stay here, Gloria, and Bill and I will take a walk."

"Where to?"

"To the trees and back. We won't be long." He hurried the young man away before the girl could protest. "We'll have a look at the bodies. If there are big animals here they may have been eaten or something. Anyway, we can

take a look at the forest and see if there are any nuts or fruits we can eat."

"Why?" Markhouse didn't seem eager to leave the girl. "There's plenty of food in the ship."

"Plenty for how long? The canned stuff won't last for ever and we may need it for the winter—if this planet has a winter. Anyway, let's find out about the animals."

Apparently there were no large animals. The bodies lay where they had placed them, still covered with the thin coating of leaves. Sam verified that they had not been touched and hastily left them. Together with the young man he made a quick investigation of the forest. The trees were all of a pattern, tall, convoluted, with thick, fleshy leaves and clusters of what seemed to be thin-shelled nuts. They broke a few off, cracking the outer rind and revealing a firm pink kernel. Cautiously Sam smelt it, tasted it, then deliberately chewed and swallowed a portion.

"Someone's got to try it," he explained. "I'm the oldest

and the easiest spared. If nothing happens we can use them as food."

"And if it does?"

"Then you'll know better than to eat them." Sam stared at the silent, almost park-like expanse of forest. There was little undergrowth, a surprising lack of insects, and no fungi of any kind. He shivered a little, touched by the alienness of unaccustomed surroundings, and led the way back to the ship.

When they reached it Miss Kirch was dying.

She had been dying ever since an invisible shaft of radiation had lashed at her from the disrupted pile, but now she was showing it. She lay conscious, despite the morphine, moaning a little as she rolled her head from side to side. Her skin was inflamed, her injured leg so swollen as to be almost unrecognisable, and her bare arms were spotted with sores. Gloria stared at Sam, her face white.

"We've got to do something for her."

"Morphine," said Bill, but he didn't move towards the ship and the medical kit. Sam shook his head.

"Too much of that stuff will kill her."

"Isn't that better than leaving her to suffer?" Gloria brushed back her hair. "It wouldn't be so bad if she stood a chance, but we've done nothing to help her." She looked at Bill. "We've got to give her a transfusion."

"But the blood groups . . ."

"To hell with that! She's dying and nothing we can do will make it worse. We've got to take the chance."

"She's right." Sam nervously cleared his throat. "We need her. She's an educated woman and we need her knowledge if we hope to stay alive."

"But how?" Bill shook his head. "She can have my blood, all of it if it will help her, but how to do the transfusion?"

"I've been thinking about that," said Gloria. "Look, there's a big syringe in the medical kit. Suppose that you were to take a syringe-ful

of blood from Bill and inject it into her arm? Into the vein, of course; that's where it has to go. Wouldn't that be the same as giving a transfusion?"

"It might," said Sam slowly. "I can't see anything against it." He looked at the young man. "Ready?" Bill nodded.

Sam took a pint of blood from Bill and injected it into Miss Kirch's arm. Then, just in case, he took a pint from Gloria and half a pint from himself. He would have taken more, but he was an old man and didn't think he could spare it. He stared down at the patient as he rubbed his sore arm, then looked seriously at Bill.

"That's all we can do. I don't know how much blood she's supposed to have, or how often. I don't even know how much blood we can spare. I feel pretty groggy myself and Gloria looks kind of pale. Maybe we shouldn't have taken so much?"

"They gave me three pints when I had a transfusion," said Bill. "But that was plasma and I was pretty badly cut up." He looked up

towards the setting sun. "Better get her inside and shut down for the night. We'd better eat, too. I don't feel so good myself."

They sat in the dim blue glow of the emergency light. Battery-powered, it resembled a hand torch and was still working. The food came from cans, tasteless but enriched with vitamins. The water was flat with the peculiar taste of distillation. Miss Kirch couldn't eat. Gloria laved her face and moistened her parched lips then looked at Sam.

"Can't we give her some more dope? She's moaning and throwing herself around."

"It'll be bad for her."

"Bad, hell! It'll be worse for her to suffer. Knock her out so we can all get some rest." There was a brittle edge to the dancer's voice and the old man guessed that she was near breaking point. He nodded at Bill.

"Give her another shot, then. One of the small doses." He waited until the moaning had died into uneasy silence. "How about you, Gloria? You want a shot, too?"

"Not for me." She stared distastefully at the syringe. "I'm no hop-head. I worked with a girl once who was crazy about the stuff. The things she did to get it! Not for me. I'd rather stay awake."

She sat down on the canted floor plates and, as she sat, the young man slipped his arm around her waist. Sam leaned against the hull, a little to one side of the couple, and tried to forget the sick woman lying towards the rear. Outside it grew dark and the tiny points of stars began to shine through the direct vision ports.

"Look at them," said Gloria bitterly. "There're men and women out there, millions of them, and we have to be stuck on this God-forsaken place we don't even know the name of. Hell! What wouldn't I give to be hoofing it in one of the joints again!"

"Me too." Bill sounded as though he wanted to spit. "I had a beautiful connection. Top salary and commission all down the line. Five years and I'd have been a partner.

Ten and I'd have been able to retire. That damn cargo ship!" He swore with unsuspected depth of feeling. "They should never have allowed the crate to take off."

"Six men lost their lives in that ship," reminded Sam. He stretched a little, trying to ease his sore muscles. "When it comes it hits us all. Maybe you've more to lose than I have, but then again, maybe you've more to win. I've had sixty years of it, breaking my back and twisting my guts trying to scrape a living out of bare rock. Sometimes I'd strike it lucky. More often I'd have to contract out to avoid starvation. I've had easy times and bad times, but the bad have outnumbered the easy twenty to one." He stared thoughtfully at the twinkling stars. "Still, I'd have liked to try my hand at the diggings on Sirius IV. I'd a feeling about those diggings."

"Talk!" sneered the young man bitterly. "I've heard you old timers talk before. You forget that you've had your chance and begrudge it to others. So what if life is hard? So what if you've got to work

for what you get? It's worth it, isn't it?"

"Maybe. If you call selling advertising, work, then perhaps you've got a point. Seems to me though that we could do without all that stuff and be no worse off. Better, maybe. Personally, at your age, I'd have given my left arm to be stranded on a planet with a beautiful woman. Isn't that what you've wanted all along? A beautiful woman I mean?"

"I was never short of girls," snapped Markhouse. "And there's more in life than chasing a skirt."

"Such as?" Sam grinned at the young man's expression. "I've lived a lot longer than you have, son, and I learned a long time ago that the object of almost everything a man does is to get a girl. He may deny it, but it's there all right. What else does he want money for if not to cut a dash? Why else does he sweat and work and grind if not to get himself a girl and raise a family?"

"You're crazy!" Bill smiled with amused contempt. "There's more in it than that.

There's the struggle to show yourself smarter than the other guy. The kick you get out of landing a fat contract. The nice warm feeling a big bank account gives. There're a million people burning themselves out in offices and in businesses trying to get to the top. They don't just want a woman and kids."

"Maybe not," said Sam quietly. "But I was talking about men." He leaned a little forward, his eyes narrowed as he stared at the girl. She was asleep, her features peculiarly relaxed and almost child-like as she rested against the young man, and the soft curve of her lips presented an age-old invitation. Bill looked down at the girl then stared at the old man.

"Well?"

"Nothing." Sam settled himself on the floor plates and closed his eyes.

He was a long time getting to sleep.

In the morning Miss Kirch was dead.

She lay stiff and rigid beneath the thin covering they

had thrown over her, her eyes closed, her skin blotched with the marks of the invisible killer, her wasted, sallow features somehow pathetic beneath her tangled mass of iron-grey hair. They "buried" her with the others and, when they had returned to the ship, Sam called a meeting.

"We may as well face it," he said abruptly. "We can sit here until we rot or we can do something to make a place for ourselves. One thing we'd better accept right now. We're not going to be rescued. Until you get rid of that notion we'll all be wasting time."

"Not rescued?" Gloria glanced uneasily over the rolling plain towards the fringe of trees. The early morning mist still lingered, giving an air of mystery to the strange boles. "You mean that we've got to stay here for good?"

"That's right."

"That's wrong," snapped Markhouse. "This is a listed planet, isn't it? Well? Others will be arriving here sometime, survey ships or colonists,

or even exploiters. We won't be alone for long."

"Listen," said the old man patiently. "This is a listed planet, but what does that mean? A survey ship touched down here and tested the air and water. We don't know how long ago they arrived and we don't know when anyone will return." He snorted at the young man's expression. "You think that I'm dumb, don't you? Well, I'm not. I forget the actual figures, but there are something like a hundred thousand planets listed as 'habitable.' About a thousand have been colonised to some extent and there are a few more with official bases and survey groups." He gestured towards the skies. "The universe is big, man! Big! And we've only had the hyper-drive for a few generations. It takes time for men to spread to every planet."

"He's right, Bill," said Gloria. "I read up about it once, or it might have been a telescreen show I saw, but he's telling the truth. We could sit here for twenty years and still not be rescued."

"They'll know the ship was lost," said Bill uncertainly. "They could back-track and find . . ."

"Where would they start looking?" Sam rubbed his gnarled hands together and shivered a little in the early morning chill. "We were heading from Deneb to Sirius and no one could know just where we emerged. But even if they did they still wouldn't come for us. Why should they? Spaceships are expensive to operate, too expensive to send one out to look for a few third-class passengers." He shrugged. "Better make the most of it, Bill. We're here for keeps."

Bill nodded, only now accepting the cold fact that they had been thrown wholly on their own resources. Instinctively, his hand sought and found that of the girl.

"What shall we do?"

"First you two get married." Sam winked at the girl. "As I'm the oldest I'm in technical command and can tie the knot. Right, so now you're married. The next thing is to find water and a

place where we can build a house. Then we've got to gather in some food; those nuts we found are edible, at least I haven't died yet, and there should be roots and seeds we could find."

"Can't we stay in the ship?" Gloria looked towards the wreck, reluctant to leave the one product of civilisation on a primitive world. Sam shook his head.

"No. For one thing there is no water here. We want to find a stream not too far from the forest but far enough to allow some protection in case of wild life." He looked at the ship. "There's another reason why we can't hang around here. While we stay close to the ship it will be hard for us to realise that we're wholly on our own. Anyway, the food can't last much longer and neither can the water." He nodded to Bill. "Let's see what we can find."

They found a couple of axes, a saw, a hammer, a full kit of wrenches and tools for the repair of the ship, some wire, assorted sheets of plastic, a coil of thin but strong rope

and a box of signal rockets. There were other things but none of them seemed of use. The equipment of the lifeboat had been designed primarily to enable the crew to survive while waiting for rescue. It had not been intended for the use of colonists and no weight had been spared for books. No one had, apparently, thought of the possibility of a group of passengers being marooned without a trained officer to guide them. A logical enough assumption, because the lifeship couldn't have landed without a trained pilot, anyway.

But it left them utterly on their own.

Their first hut collapsed within six months. They had cut saplings and lashed them with wire and, when that had run out, with thin branches and creepers from the forest. The wood had warped, the vegetable binding had rotted, and the wire had broken beneath the strain. The roof had collapsed, severely bruising Bill and almost killing Sam. Gloria was unsympathetic.

"If that's the best you can do then I don't think much of it." She looked at the wreckage. "Hurry up and rebuild it. It's beginning to get cold at nights and we need shelter."

Bill rubbed his bruises and looked at the old man.

"She's right. Can't we build something stronger?"

"If we had the time we could split the trees into planks," said Sam slowly. "I suppose we could even burn holes and fasten them together with pegs, but it will take a lot of time." He kicked at the jumble of logs. "Let's interlock the ends, pack dirt around it, and have a sliding door. We can use the perspex from the ship for a skylight." He kicked at the logs again. "Let's get busy, it's getting cold."

They had rebuilt the hut before winter and crouched over a smoking fire as bitter winds whined overhead and sent showers of sparks from the glowing wood. Ice followed the wind, and snow, and they ate the last of the ship-food and most of the stored nuts before the weak sun of spring allowed them

outdoors. But during the winter they pooled their knowledge and searched their brains for useful information.

It wasn't much.

A commercial traveller has no need of a knowledge of carpentry. A rock miner does not learn agriculture and, though he works with metal tools, he does not have to know how to smelt iron, temper and shape it, work it into usable shapes and convert scrap into tools. A night club entertainer does not have to know anything but how to display her body to best advantage, to smile and kick her legs in time with music.

All were products of their age. They had lived in a world of plastics, packaged goods, canned food, of replacement units and technicians. Each was a specialist in their own particular, narrow field, because competition left no room for other than specialisation. Civilisation was an interlocked mesh of tiny cogs, each dependent on the other and each helping to drive the whole. But remove a cog from its setting and it was helpless—as a man.

The saw failed them in the spring. Bill swore as he tried to cut through a newly felled tree, cursing as the tool stuck and bent, then irritably wrenched it from the sap-oozing gash.

"Damn thing's as blunt as hell! How do we sharpen it?"

Sam didn't know. Neither of them being carpenters, neither knew anything about the setting of the teeth. The axes were an easier problem. Sam sharpened them on a stone, frowning as he saw the pitted surface of the fine steel.

"This atmosphere must contain a lot of oxygen," he said. "It's combining with the iron already, and this stuff is supposed to be stainless."

"Will it hurt us?" Gloria looked up from where she sat sewing leaves together to form crude garments to replace their own tattered clothing. Sam shook his head.

"I doubt it. But if we want to salvage the metal of the ship we'd better hurry."

They hammered at the thin hull plates until they had wrenched them from the

struts. They collected everything of value from the site and carried it to the hut near the river they had found. There they piled it into a heap and concentrated on the essential job of cutting fuel and gathering food. The second winter came and passed and the salvaged metal was a heap of rust and still-recognisable alloy.

"We ought to smelt it down and make something of it," said Bill. "Knives or something useful." He smiled at Gloria. "If we can't use them our kids can—when we get kids, that is."

The third winter came at the end of a wasted summer in which they had tried every way they could think of to melt the metal. They failed. The fusing point of the alloy was far higher than any heat they could obtain in their wood fires. None of them had heard of charcoal, and even if they had, they would still have had to rediscover the Bessemer process. Spring came again and Gloria took Sam to one side.

"There's something wrong

with me," she said abruptly. "Bill and I have been married over three years now and no children." She stared at the old man, a thwarted hunger in her eyes. "What can I do?"

"Don't worry about it." Sam tried hard to be cheerful. "We all got a dose of radiation back in the wreck and that causes temporary sterility."

"For how long?" She bit her lip. "I want children. Funny, when I was working back in the joints I didn't want kids at all. All I wanted was to get to the top and stay there. Now that doesn't seem important any more. We're here and we've got to make the best of it, but how can we do that without children?"

"What does Bill think about it?"

"The same as you. He wants children, too; he's even made a couple of toys for them, a rocket ship and a swivel-armed bear." She smiled in tender memory of the long hours of arduous work the manufacture of even such simple toys must have been to the young man. She looked at Sam. "Can you help us in

some way? The medical book or drugs or something?"

"I don't think so." He forced himself to be cheerful. "I'll try. Personally, I think everything will be all right as soon as you stop worrying about it. I'll bet that you're nursing your first-born this time next year."

He was wrong. The year passed and another after it. They had built a second hut for a store and a third for the old man, who had insisted on privacy. A great heap of logs rested against stakes driven into the soft loam, fuel for the winter, and, well away from both huts and logs, a great fire burned day and night.

They had lit it with one of the signal flares and, though they never put it into words, each knew just why the fire was there. At night they heaped it with dry timber so that the flames shot up a full ten feet into the balmy air. During the day they piled wet leaves on it so that a column of smoke coiled itself towards the clear blue of the skies. It was futile, but it was all they could do.

"They'll never come," said Gloria, bitterly. She had long ago lost her superficial glamour but, with her clear skin and supple body, she needed no cosmetics. "We're stuck here for ever."

"Is that bad?" said Sam. He sat very near the fire, warming his old bones at the heat in a desperate effort to ward off the too-familiar chills of approaching death. Bill sighed.

"It could have been wonderful. No animals, a fairly decent climate, plenty of food growing for the effort of collecting it." He sighed again, expanding his muscular chest. "But what's the good of it—to us?"

Sam nodded, knowing just what he meant. With children, the planet could have been a paradise, a veritable Eden. Here they could have found the one thing which all men, and all women, despite what they said, secretly craved for. A world of their own, a place they could settle free of worry and care, a quiet spot in the sweeping tide of commercialism where a man could

be a man again and not a glorified robot jerking to the whims of irrational superiors and fluctuating markets.

"I'm a failure," said Gloria bitterly. "Up there," she gestured towards the stars above, "I was a success. I had a new contract, a booked spot on an interplanetary network, my name in lights, everything. Here I'm the most useless of all creatures, a barren woman." She turned her head to hide her tears. "Bill! I'm sorry!"

"Forget it!" He took her in his arms and hid her tears against his chest. "It isn't your fault. It isn't anyone's fault. Don't worry about it."

"How can I help but worry?" She turned from him and looked again at the stars. "What have we got to look forward to here? Work and idleness and nothing to show for it at all. If we had children it would be different. We could have taught them, watched them grow, played with them and been young again in their youth. But now we're going to grow old.

We'll begin to hate each other because we see too much of each other. We're going to quarrel and argue and fight. Then, when we're really old, we'll just sit and wait for death and . . ." She swallowed. "What about the one that's left?"

"Don't worry about it," said Sam. He was glad that he would be the first to die. Somehow death didn't seem so bad when you were surrounded with friends. He didn't like to think of what it would be like if he was the only one alive on the planet. "You're both young and a ship is bound to arrive before long. Just keep the fire going so that they will know where to land."

"Yes," said Gloria, and threw another log onto the fire. "That's all we can do now, isn't it? Just sit and hope for rescue. Just pretend that tomorrow doesn't exist and yesterday never was. Just live for the day when a ship will come to take us away from here."

But it never did.

When Alec learnt to write science fiction, came——

Wedding Bells for Sylvia

by LEN SHAW

SOMETHING CAME THROUGH the letterbox. Thud . . . !

The bulky envelope was addressed to me: Mr. Alec Trott, c/o Mrs. Mapleton, Elm Lodge, Handsforth Parade, Casterwold. The crooked capital "M" was unmistakable. The typing was my own.

The letter inside, headed *The Psy-Sci Magazine*, was signed "J. Lowndes—Editor." I re-read the last paragraph a dozen times.

"Your story is, word for word, one I have recently accepted. This is the third I have rejected for the same reason. Do not submit any more. I am a busy man."

Feeling sick, I sat on the stairs. It was incredible. Fantastic.

I'd been writing for the women's mags for years. The ageless formula. Boy meets girl. I churned out one a week. Could have doubled my output; but why bother? I sold them all. I was doing very nicely.

Until I tried science fiction . . .

My tally to date was three s-f stories. Three rejections. Three accusations of plagiarism . . .

I was shattered. It was like a bad dream. A stinker.

"Sorry, darling." My pacing feet sank into inches-thick carpet. "Another rejection. My nerves are haywire. Forgive me."

Watching from the settee, Sylvia smiled faintly. Her brows were arched gold over yearning blue eyes.

"Why postpone the wedding, Alec? You're bound to have an occasional set-back."

I humped my shoulders, irritated by Silvia's obtuseness. I was ill at ease, anyway. Always was in this ornate lounge under the massive roof-tree of her family, Bigwoods, the merchant bankers. It was difficult to explain the simple arithmetic of the situation.

I stared down at her.

"The postponement's unavoidable, Sylvia."

"But, surely——"

"Three flops in a row!" There was more to it than that. My increasing reluctance to churning out love stories made the situation critical. "I never pretended to support you in your accustomed style, Sylvia. But at this rate, I just can't support you. Period."

"If it's a question of money——"

"Let's keep the Bigwood millions out of it."

"I was only going to suggest——"

"Don't. If I can't support a wife, I don't get married. At present there's some doubt——"

"Alec, you're in real trouble!" With a lithe movement Sylvia stood beside me. She put my arms around her waist, uplifted her face, her blue eyes yearning. "Darling..!" Enticing lips zephyred a perfumed whisper. "You're very brave, all on your own some. But a trouble shared——"

"Please, Sylvia . . ."

I was tempted to lay my head on her breast and pour

out my woes. The solace she offered seemed infinitely desirable.

Then her lips brushed mine, and my moral fibre snapped.

"Darling . . ." I choked.

For a pottage-mess of sympathy, I was prepared to sacrifice independence, artistic integrity—everything.

She drew her head back, smiling. She gave me that certain look—and my backbone snapped back into place.

I've seen that look a million times. The mother-knows-best look. The woman with the baby on her knee has it. So has every male-dominating female. I've even seen it on the face of a woman of fifty as she patted her husband's face, calling him a silly boy and poo-pooing his mortal dilemma. It's a look I dread. If you yield to it once, you're a lost soul.

I freed myself from the Circe-embrace. "I just want a little time," I growled. "I'll get it sorted out."

Walking back to the digs that night, I thought things over. Wedding talk had been postponed for a month. Meanwhile I had to make a decision.

The situation had an unstable factor—myself. Love made the world go round; also, it had provided me with a steady income—until I'd switched to science fiction.

Result—disaster.

Unconscious plagiarism three times running carried weird implications. I was too scared to probe into them deeply.

Anyway, I'm no scientist.

So I did the sensible thing. I decided to cut my losses and stick to romance; and I was so pleased with myself that I cooked up a plot right away.

Back at the digs, I went straight to my desk. I scribbled the title, sat back and wondered how to begin.

Two hours later I was still wondering.

By then I was really scared.

There was nothing wrong with the story. I'd written manylikeit. I just hated its guts.

I wanted to write science fiction; but what was the use? Although the plots appeared out of the blue, they were too infrequent. Not a paying proposition. Besides, look what happened when I tried to sell them!

At midnight, without another word written, I packed up and went to bed; and the dream hit my mind—socko..!

I was typing. Knocking out a story about a spaceship running amok in the Milky Way, with time-dilution complications. I finished it, put it in an envelope with a covering letter—and woke up.

I was sweating. Petrified. Because I'd remembered something.

The three other s-f stories had happened this way. In dreams. I had remembered the stories, but not the dreaming of them. As for the time-dilution theory, I'd never even heard of it before!

I sat in the dark, thinking. None of it made sense. The more I thought, the more fantastic it seemed. Soon, I had to give it up—or start gibbering. So I gave it up.

Next morning I had a problem on my hands. Write up the dream story? Or not? Remembering the previous fiascos, I decided not to risk another.

I wrenched my mind back to romance. Thought up a new plot. Scribbled the title.

Hacked out the first two paragraphs. Then got stuck.

At ten o'clock I 'phoned Sylvia.

"But Alec!" She sounded alarmed. "You should be writing."

"I know."

"Trouble?"

"Yes."

"Can I help you?"

"Let's play golf."

She agreed, though that wasn't quite what she meant. But, hell! I was the captain of my soul. My head was bloody—and bowed; but I was going to stay captain!

In the club house after the game, when I took the drinks to the little table, there was that certain look in Sylvia's eyes. As she sipped her sherry, she yearned at me.

"Alec," she said presently, setting her glass down and laying her hand on mine, "there's something terribly wrong. I felt it while we were playing. There's no sense in fighting a lone battle, darling. Do let me help you."

"You're very sweet, Sylvia. Thanks a lot." I turned my hand over and squeezed hers.

"There was a problem, but I

sorted it out while we were playing. There's no problem now."

"Oh . . . !" She looked frustrated; then she brightened. "Maybe giving you a game helped? Just a little?"

"Made all the difference!"

Maybe it had, though I suspect that sunshine and fresh air had made the major contribution. Anyway, I had soon pinpointed the trouble. I'd been trying to write romance with half my mind, while the other half cavorted round the Milky Way; and it just wouldn't work.

I'd made another decision. Final, this time. Irrevocable. I was going back to the boy-meets-girl racket with a whole mind—and to blazes with science fiction!

A month later I had not written a word. I was haggard, sunken-eyed, unkempt. Unfit to live with. Unfit, almost, to live.

Relations with Sylvia were strained. The more morose I became, the more she wanted to help. The harder she tried, the more I resisted. I refused to compromise my indepen-

dence, my artistic integrity. Heaven only knows why—its market value was nil.

One morning I shambled into a bookshop, glared at the rows of periodicals, and picked up a copy of the *Psy-Sci Magazine*. The third title in the index was "The Cruise of the Adastral." That gave me the first jolt. I skimmed the first two paragraphs; then, shaking with excitement, I bought the magazine, found a bench in the park, and read the story through. I felt molten with fury by the time I'd finished.

I sighed, groaned, puffed and swore. No doubt about it. Except for a few idiomatic variations, it was word for word the last story I had written. The one I'd submitted to the same magazine. The one that had bulleted back with insinuations of plagiarism.

Seething like a super-nova, I glowered at the "author's" name. Billy McMinny. It didn't mean a thing!

I went back to the shop. "I've just bought the July issue of the *Psy-Sci Magazine*," I told the assistant. "Have you the May and June issues?"

"Sorry, sir. Can I order them?"

"How long——"

"About a week."

"I must have them today."

"Why not try Piploe's, the second-hand bookshop? They carry large stocks of science fiction."

"Thanks a lot," I said, and was on my way, practically running.

I bought the two back numbers at Piploe's. They confirmed my suspicions. Each carried a story by McMinny. The titles were familiar. Mine!

Back in the digs, I read them through, then stormed up and down. I was berserk. I'd have killed McMinny on sight!

They were all my own work. All three of them. Verbatim—except for the odd phrase here and there.

A fantastic theory flashed into my mind. I'm no scientist, and telepathy is not in my line; but it *is* an established scientific fact. So my theory was, at least, remotely credible.

If I wrote up scientific themes, I argued, I must have received them telepathically. In my dreams. How else could

they have come? So far I had received one a month, and on that basis the next was due now.

Simmering, I made plans. Next time my dream work appeared in print, the by-line would be "Alec Trott." I would take good care of that.

I slept hopefully that night—but dreamlessly.

But I made up for it the following night.

I was going to bed about ten, when Sylvia rang. She arranged to pick me up at two the following day. A run in the country, picnic tea and a heart-to-heart talk were scheduled. Phew . . ! I didn't relish the prospect. I cut the call short.

The dream was typical. I typed a story entitled "Star Sailor," put it in an envelope with a covering letter—and stopped dreaming.

The alarm clock wakened me at five. Ten minutes later, I was typing frantically. By nine the story was finished. I left a message for Sylvia with my landlady, and just caught the train to town. An hour later, I followed my card into the office of the *Psy-Sci*

Magazine and handed the story to the Editor.

"I'm Alec Trott," I said. "You rejected my first three submissions. Someone else sent them in first; but this one—"Star Sailor"—is different. I produced it overnight. You *can't* have seen it before."

The Editor looked me straight in the eye. He put my typescript down. Picked up another. Gave it to me without a word. I stared at it, and my scalp crawled.

"Star Sailor," I read. "By Billy McMinny."

The floor began coming up. But I fooled it. I dropped into a chair.

"Sorry," said the Editor. He smiled faintly, turning towards the window. "I think you two ought to get acquainted."

A burly individual strode towards me from the window. A debauched, disinterested, stubbly face stared down. I might have been a sack of potatoes. Bad potatoes.

"McMinny," said the Editor. "Meet Alec Trott."

"Not the fellow who—" "Precisely."

McMinny loomed over me like a thunder cloud. "You filthy fake!" he roared. "For two pins I'd——"

"That'll do!" snapped the Editor. "This is an office, not a boxing ring."

An office boy came in and gave the Editor a slip of paper which he handed to McMinny.

"Your cheque for 'Star Sailor'."

"Thanks."

As McMinny put the cheque in his wallet, the Editor smiled at us enigmatically.

"What's on your mind?" growled McMinny.

"Just this," said the Editor. "You gentlemen have much in common. Get together and talk things over. Let me know when you reach some agreement. Meanwhile, 'Star Sailor' is the last story I'll take from either of you."

McMinny downed his third pint and squinted at me malevolently. "You're crazy!" he rumbled.

I looked anxiously round the bar, having no wish to broadcast our dilemma. But we were the only customers,

and the barman was some distance away, whistling and polishing glasses. I gulped a mouthful of whiskey. I needed it.

"Get your mind off the beer," I advised him. "We've got to come to an agreement. Quickly. I have a train to catch."

"Go catch it."

"No," I said steadily. "I'll re-cap instead. You were a research physicist with a good job. Along comes trouble. Woman-trouble?"

"Mind your own damn business!"

"Thought so!" I grinned. It did me good to see him squirm. "So you hit the booze. Went to pieces. Lost your job. Then what?"

"What?"

"You're a scientist. A science fiction fan. And you've got imagination. So when the money runs out—and the beer—you try your hand at writing s-f stories. But it's no go. Your Ideas Department is bulging; but you're short on technique. Can't string two paras together. So it's a dead loss, until——"

"Go on."

"Well, you kept trying and failing. The more sober you got, the harder you tried. Then one night during the early hours, you typed a story straight onto the paper. Non-stop. No revision. Clean as a whistle." I snapped my fingers. "Just like that."

Behind the stubble, McMinny registered astonishment. "How d'you know, Sherlock?" he glowered.

"For my sins," I complained bitterly, "you picked on me. Telepathically. I dreamed that I was typing the story, while you actually did type it. Naturally, your copy reached the Editor before mine. Twice. This time I tried to get in first." I shrugged. "But——"

"So what?" he jeered.

"What it boils down to is this," I said evenly, though I'd have liked to spread his nose all over the bar. "We're collaborators. You supply the plot. I have the know-how. So let's get organised—on a fifty-fifty basis. As there's two of us to keep, we must step up production. A story a fortnight to begin with.

Then one a week. Dammit, man!" I boiled over. "Don't look at me like that. Face the facts. We're collaborators, willy-nilly!"

McMinny hiccoughed.

"Go to hell," he grated, "willy-nilly!"

The next month was the longest in my life. I reasoned this way. McMinny was in funds and drinking hard; but in a month he would be broke—and sober. To get beer money, he would resort to telepathic collaboration. Or, at least, try to.

But I was ready for him. This time his efforts would misfire. No dream for me. No story for him. And in a couple of days he would be after me with his tongue hanging out.

I was wrong, though. It took a week to bring him to his knees. And when he did pay me a visit he was in a pitiable condition.

"Come in, McMinny." I opened the door wide. "I've been expecting you."

"So you were at the bottom of it!"

"On top," I said, "and stay-

ing there." In my study I waved him to a chair. I perched on the table. "No collaboration without my say-so, McMinny," I grinned. "And first you agree to my terms."

"Which are . . .?"

I tossed him an agreement, typed in triplicate. It was all-embracing; but its main stipulations were one story weekly and equal division of the proceeds.

He scanned the document, then jumped up. "It's black-mail," heroared. "I won't——"

"Shut up!" I jerked a thumb over my shoulder. "The door's there. If you don't want to sign—get out!"

He signed all three copies. I kept one myself, gave him one, and put the third in an envelope addressed to the Editor of the *Psy-Sci Magazine*. Then I produced some beer.

McMinny left at 7 p.m.—with a fiver I'd lent him against my better judgment—for his train fare, etcetera. It was the "etcetera" that worried me.

The first story was to be written that night. McMinny

would tackle it, with my telepathic assistance, shortly after midnight. At 4 a.m. it would be finished. At nine it was to be handed to the Editor of the *Psy-Sci Magazine*. At ten McMinny was to 'phone me and report progress.

"And no funny business!" I warned as I showed him out.

He turned on the step, humping his shoulders. "You've got me in a cleft stick, pal. Er—by the way!" He stroked his stubbly chin. "You didn't tell me how you evaded mental contact."

"I'm not going to," I said. "Goodbye."

I closed the door, and yawned prodigiously. I decided to go to bed at nine. Eight, maybe. After a fortnight's trial, I was convinced that sleeping during the day didn't suit me at all.

That evening, Sylvia rang at nine. My conscience kicked like a mule. Since 'phoning regrets five weeks ago, I'd not seen her. Nor spoken to her. I'd wanted to, but not till I'd settled McMinny; and she, naturally, had waited for me to make the first move.

"That you, Alec?"

"Oh—hello, Sylvia."

"I can't stand this any longer, Alec. We're engaged—remember? You've been deliberately avoiding me. Oh, I know there's some kind of trouble, but that's no help to me."

"I wanted to spare you——"

"You're sparing me nothing. How d'you think I feel? If I'm to share your life, Alec, I'll share your troubles. Or else . . ."

It was an ultimatum. Confide in Sylvia—or lose her. I didn't want to do either, so I temporised.

"Give me another day or two."

"No more days."

"Just one."

"None."

"Sylvia, if only——"

"I'll see you tomorrow."

"But——"

"No 'buts'."

"Well—okay, then."

"I'll be round for you at two."

Sylvia rang off, and I cradled the receiver and went to bed.

Everything went according to plan—except that McMinny

didn't 'phone at ten the next morning. By eleven I was furious. By noon, frantic.

I had dreamed my dream, and McMinny would have typed the story. But what had happened to him—and the story—since the early hours?

There was only one way to find out.

I caught the midday train to the City. It had gone three when I panted up the echoing wooden stairs of an old house in the East End. There was no answer to my knock, so I marched into McMinny's one-room flat.

The place was a shambles—dust inches thick; the sink full of pots and pans; books, magazines and newspapers everywhere; and empty beer bottles galore. On an iron bedstead, flat on his back, fully dressed, purple-faced, snoring, McMinny was sleeping off the effects.

I found the story on the table beside the typewriter and examined it briefly. It was complete, even to the title page bearing the names of the joint authors.

"Thank heaven for that!" I muttered.

"Why . . . ?"

I spun round and goggled at the doorway. Sylvia stood there. She looked like all five Furies rolled into one.

The Trott-McMinny partnership survived its birth-pangs. It still functions. Still produces first-class science fiction, though at irregular intervals.

The pattern was quickly established. On the one hand an incorrigible drunkard. On the other, Sylvia's husband—hard-working, systematic, and a total abstainer.

It was wedding bells for Sylvia a week after she followed me to the City. I made the mistake of leaving McMinny in her care while I delivered the story myself. He was in a pitiable condition, and Sylvia's frustrated instincts found fulfilment at last.

Pity, though, that McMinny responded so quickly. He reformed over night. Became very tetchy. Very independent.

Pity, too, that I hadn't realised how much Sylvia meant to me—until I'd lost her. It bowled me over. Knocked the bottom out of things.

Last time I met her, quite by accident, the yearning was back in her eyes. The frustration. Stronger, more terrible than ever.

Because McMinny, back on his own two feet, had freed himself from her apron strings. Pushed her out on the sidelines. Threatened divorce if she didn't stop messing him about.

The way she looked at me made me weaken—but, what the hell! If she came back, legally or illegally, she would get the same raw deal again.

What she really wanted, I told her, was a baby. But she'd thought of that, and the doctor had told her she would never have one.

Well, that's life. You don't value what you've got until you haven't got it. And when you get what you want, it isn't what you thought it was.

I'm on my last bottle now. Soon I shall be stone cold sober. The next dream is on the way. The next Trott-McMinny production.

So here's to collaboration, telepathic or otherwise. may the next cheque be a fat one.

Bottoms up!



FICTION

The **END OF ETERNITY**, by Isaac Asimov, is, we think, his greatest work to date. In the past, Mr. Asimov has produced books that either are so complex in their structure as to be fully intelligible only to the experienced science fiction fan (e.g. *Foundation*) or are hardly above the level of the second-best authors (e.g. *Currents of Space*). His latest book places him unquestionably at the top of the tree—a position albeit shared by one or two others. *End of Eternity* is splendid writing, careful thinking and—most important of all, perhaps—lucid.

Even the great masses of people who merely dabble in science fiction will fully understand the intricacies of Asimov's time structure. And they will be relieved to find

such excellent characterisation and story value in a medium which they may have considered to be largely concerned with gadgets.

Because it is so expertly constructed, *End of Eternity* is a difficult book to summarise. Every page is necessary to a proper understanding of the book. But perhaps we can give a picture which, though rough, will convince you that you should read this book.

To start with, the story has no time location. It is positioned in *all* time. There are two kinds of humans—Timers, who live much as we do, three-dimensionally; and Eternals, who, while not immortal, are able, with the appropriate machines, to travel either way through Eternity, and from Eternity through selected "doors" to time as we know it. The Eternals are devoted to the

good of all mankind—at least they are devoted to what *they* consider is the good of mankind. They effect Reality changes, according to vast and complex computing operations, so that the bad in life will disappear from the time stream. But they have a worry.

To tell what the worry is would spoil the first half of the book, so we'll merely hint that it is concerned with the Hidden Centuries—those above the 70,000th into which the Eternals, try as they will, cannot enter; and with the problem of turning full circle. In a word, they are worried about the end of eternity.

But do, please, read it for yourselves. From Doubleday (575 Madison Avenue, New York 22, U.S.A.) at \$2.95.

NON-FICTION

For those who desire a short but comprehensive account of the science of stargazing, **A BRIEF TEXT IN ASTRONOMY**, by W. T. Shilling and R. S. Richardson, is ideal. With all side issues cut to a minimum, the book, nevertheless, succeeds in presenting a very well-balanced

picture of modern astronomical fact and theory. The book is intended to be of use to readers lacking a scientific education, and such who are prepared to take a little effort will not find it hard going. Certainly a must for serious science fiction fans. From Chapman and Hall (37 Essex Street, W.C.2) at 32s.

Few things are more vital to the continuation of civilisation than energy. Most laymen know this, but few of them realise how energy-supply permeates into every nook and cranny of our lives.

They can now pleasurably correct that deficit in their knowledge with **MAN AND ENERGY**, by Professor A. R. Ubbelholde, F.R.S. Here in moderately popular language, we find a very complete account of the human uses of energy, right up to nuclear fission. The style is quick, amusing and very precise. The information is detailed but not boringly so, and the statistics which are brought in are exceedingly appropriate. Highly recommended. From Hutchinsons (Stratford House, W.1) at 18s.

The story of atomic energy production in Britain is the

sub-title of **BRITAIN'S ATOMIC FACTORIES** by K. E. B. Jay—one of those valuable but cheap Stationery Office publications. At this moment, when the whole world is gasping at Britain's tremendous advance in this field, this book is highly topical. It surveys the background and development of the last five years of British achievements in the production of atomic energy. Well-written and nicely "gossipy," this book is well worth the 5s. it costs from Her Majesty's Stationery Office (York House, Kingsway, W.C.2).

THE LAWS OF NATURE, by Professor R. E. Peierls, C.B.E., F.R.S., is the kind of book that should be read by every reader who relishes our articles. It deals with the development of physics from the stage of Newton's Laws of Motion, through subsequent progress leading to quantum mechanics and relativity—and then on to what Peierls

knows best, subatomic physics. And yet this is all done with only a sprinkling of technical terms and no mathematics at all. We would prefer that the title were a little less expansive, though if it is interpreted in a purely physical sense—as done by the author—no harm will ensue. This book tells clearly and succinctly what we know about the behaviour of matter. It does *not* explain how the universe works, or even if there is a universe at all. To get the most out of the book, we must adopt a strictly materialistic attitude. After we have read it, we may with profit think it over in terms of a wider and less biased approach to existence. But if you are not troubled with epistemological questions—and there is no reason why you should be—and simply want an accurate and highly readable account of modern physics and its background, this is the book for you. From Allen and Unwin (40 Museum Street, W.C.1) at 21s.



Projectiles

BRIGHT FUTURE

I have just finished number 58 of *Authentic* and I feel I must write and congratulate you on being the first science fiction magazine to produce an edition in which I could read, understand and enjoy all the stories. I feel science fiction is in danger of becoming too technical, too morbid and gruesome, and very unrealistic. Let's have some bright science fiction stories! Surely there must be a few authors who believe there is a possibility of a happier world in the future and not one blown to bits by hydrogen bombs. Also, I feel, science fiction would benefit a lot by being a bit more human. How about a science fiction story centred around a typical British family? Please, let's have more stories by J. T. McIntosh, Charles Eric Mainie, John Christopher and Jonathan

Burke. Just one grumble—your full-length story seems to be getting shorter and shorter. I feel that if you have not enough space to publish a really full length story, the best plan would be to have that story in serial form. However, whatever may befall us in the future, I hope *Authentic Science Fiction* magazine will still be going strong (and still improving—if that's possible) in a hundred years time. T. J. Potter, 2 Laburnum Cottages, Tavistock, Devon.

We are convinced that the future will be bright, Mr. Potter, and we look with somewhat biased eyes at stories which depict such a future (hint to would-be contributors).

SCIENCE

For many months, indeed ever since your magazine came to grace the bookstalls, you have beseeched your readers to send in their criticism and praise. I have always

shied from writing this letter as any complaints I had had were minor. But now I'm afraid *Authentic* is starting to read too much like a text book. I don't mind the science in the stories; as a matter of fact it's comforting to know that none of your authors will come up with a "bem." However, "ugh" is all I can say for the articles; just don't like 'em. What about the poor old layman who buys science fiction to read, just that? Stories are good. How about some more by Bryan Berry and Ted Tubb? By the way, who wrote "Death Wish?" I'd say Martin Jordan. If you want to disclose the author's name later, please put it in a forthcoming editorial. I am fourteen and would like to make contact with fans of my own age in America or the U.S.A. with a view of swapping mags and talking S.F.

Barry Itzstein, 39 Newcastle Street, Perth, Western Australia.

Sorry, Barry, but you're in a minority—and although we do our best to keep the minorities happy, we can't make such a radical change of policy for only a few readers. Why don't you persevere with the articles? They are really not difficult and you shouldn't shy away from everything that takes a little effort to understand.

CLUB WANTED

I am truly able to assure you that I enjoy all the articles in this

magazine. My interest in future interplanetary flight has led me to purchase many technical books on the subject of rockets, jets, astronomy and astronautics. Unfortunately, I have not been able to contact a club in the surrounding district and I have read in your magazine how you have helped people to find such clubs. I would be grateful if you would do the same for me.

J. R. Knowles (Jun.),
167 Parkdale Road, Sheldon,
Birmingham 26.

Glad to see you take an intelligent interest in the factual bases of science fiction, Mr. Knowles. Your nearest club is the Birmingham Circle. Contact Mr. Barton, 40 Regent Road, Birmingham 21.

CLUB STARTED

In a recent copy of your magazine (No. 58), I read a letter by another fan in the Bucks. area, appealing for the formation of a club. We have met and are trying to start one together, but the response has been very poor. I have an extensive S.F. library, about 300 mags and 60 books, and this would be available to club members. As soon as we have a large enough membership we can start a fanzine, and we have many other ideas on our future programme. Forgetting our worries, I would like to comment

on *Authentic*. I read one of your early copies (No. 15?) with a great struggle, then threw it aside, muttering "trash!" under my breath. Then, some time later, I bought No. 31 in a moment of boredom and read it. It was wonderful and I have been a regular collector-reader ever since. Your magazine has improved out of all proportion lately, your covers have become excellent, and I like the present method of interior illos. My only suggestion for improvement would be a request for more illos by Mortimer (or others) per copy.

E. R. Hedger, "Devonia,"
Chiltern Road, Wendover, Bucks.

We hope this little bit of publicity will bring you some members, Mr. Hedger. Let us know how your club gets along. We'll always print

progress news of your—or any other—fan club. Glad you like the magazine, too. We are looking into the matter of additional illustrations.

MAGS—STAMPS

If any readers are interested, I have a large number of science fiction mags, including a full set of *Authentic* that I would exchange for foreign stamps, either as a whole or separately.

P. Townsend, 10a High Street,
Huddersfield, Yorks.

*We think you will soon be hearing from somebody, Mr. Townsend. The full set of *Authentic*, at least, ought to fetch a comely stack of stamps. Surprised you're willing to part with 'em!*

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Mr. F. C., Hull.

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Gunner R. E. S., B.A.O.R. 12.

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Mr. H. W., Bermuda.

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